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FOREST RESOURCES OF SOUTHWEST LOUISIANA

by

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A Progress Report by

THE SOUTHERN FOREST SURVEY

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FOREWORD

The Forest Survey, which is a part of the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928 to make a nation-wide study of our forest resources. The five-fold object of this study is: (1) to make an inventory of the present supply of timber and other forest products, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products, and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies may be formulated for the effective use of lands suitable for forest production.

This release is based on a field survey made Dec. 1, 1934, to March 30,1935 and on two field canvasses of forest industrial plants to determine forest drain, the last of which was completed during March 1938. It should be regarded only as a progress report since it contains Forest Survey data that will be included in complete reports to be published later, and that, although considered reliable, are subject to correction or amplification as the work of computation proceeds. Item 4 above, which is being studied on a national basis, is not discussed in this report.

In the interpretation of these data, it must be noted that owing to the sampling method used in collecting them, the greater the number of samples in any given classification the more accurate are the data for that classification. Hence classes that are of infrequent occurrence and relatively small in quantity generally cannot be determined with as high a degree of accuracy as classes that occur more frequently and in substantially greater quantities. Small tabular items are to be taken as showing, not the exact magnitude of the classes involved, but their relative magnitude in comparison with those of other classes.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

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FOREST RESOURCES OF SOUTHWEST LOUISIANA

General Description of the Unit

Southwest Louisiana was once famed for its magnificent stand of virgin longleaf pine. Between 1890 and 1930 much of this timber was cut, and at present this unit contains the largest area of clear-cut longleaf land west of the Mississippi River, or more than a million acres. The unit (Forest Survey Louisiana Unit No. 3) consists of six complete and seven partial parishes, containing 5,774,200 acres. Roughly triangular in shape, it extends northward from Calcasieu Parish to include as the northern boundary Sabine, Grant, Natchitoches south of the Red River, and the hill portions of La Salle and Catahoula Parishes. The Sabine River forms the western boundary, while the eastern limit is an irregular line between the pine land of this unit and the hardwood bottoms and prairie lying to the east (map, fig. 1).

Lake Charles in the southern part of the unit is the largest town, but Alexandria is just outside the unit on the Red River. Agriculture and lumbering are the chief industries. Although 79 percent of the area is still forest land, the clear-cutting policy followed by the large pine mills has practically exhausted the timber supply over large areas, so that several former sawmill communities have been almost entirely abandoned.

The south half of Calcasieu Parish is a low, flat prairie with timber growth confined to the better-drained land along the streams. North of this prairie is a flatwoods belt that averages about 20 miles in width and that, although poorly drained, is productive forest land. The flatwoods merge into a series of low benches, which are progressively higher northward and eastward from the Sabine River, becoming quite rugged in such places as the Kisatchie Hills in Natchitoches Parish. The Red River bottoms, which average 5 to 10 miles in width, separate the hill land of Grant and La Salle Parishes from the rest of the unit. Elevations range from 20 feet above sea level at Lake Charles, to 300 feet in Sabine, Natchitoches, and La Salle Parishes. Alexandria, on the Red River, has an elevation of 75 feet.

The soils most intensively used for agriculture are those found in Calcasieu Parish and the Red River bottoms. The Lake Charles and Crowley soils of Calcasieu Parish are black to gray coastal-prairie soils with yellow to mottled gray subsoils, and are used chiefly for rice production and grazing. The Red River alluvial soils, which belong mainly to the Miller series, are dark reddish-brown clay, very fertile, and well adapted to cotton production. The flatwoods and upland soils are less desirable for agriculture, but their ability to produce timber has been demonstrated by the occurrence of old-growth longleaf pine stands that contained up to 30,000 board feet per acre. The Caddo, Beauregard, and Norfolk soils of the flatwoods have a light gray topsoil with a gray mottled or yellow, impermeable subsoil. In the rolling uplands the surface soils are gray or light brown with red to gray or yellow, poorly drained subsoil. Susquehanna and Ruston soils are most common.

The Sabine and Calcasieu Rivers, with their tributaries, flow southward into the Gulf of Mexico, and drain all but the northeast part of the unit; this is drained chiefly by the Red and Little Rivers, which join outside the unit and flow southeastward into the Mississippi. Only a small proportion of

the land surface has been used for agricultural crops, and since gentle slopes are common, erosion is less serious here than in north Louisiana. There is little or no erosion in Calcasieu, Beauregard, and Allen Parishes, or in the stream bottoms, but the rest of the unit has slight sheet erosion with occasional gullies.

Long warm summers with short mild winters are the rule. Temperatures during the summer season range from about 50 to 110° F., while winter temperatures range from slightly above zero to about 90° F. Winter temperatures are very changeable. The average date of the first killing frost is Nov. 15, while the average date of the last killing frost in the spring is March 10, giving an average frost-free season of 250 days. The average annual rainfall is 50 to 55 inches per year.

In this area there are six main railroad systems. The Kansas City Southern and Missouri Pacific go to northern points from Lake Charles by way of Shreveport and Alexandria, respectively. Mainline east and west transportation is provided through Lake Charles by the Southern Pacific; through DeRidder into Texas by the Atchison, Topeka, and Santa Fe; and through Alexandria by the Texas and Pacific. The Louisiana and Arkansas from New Orleans enters the unit at Alexandria and continues northward to Arkansas. Rail service is adequate for the area, but the decline in tonnage of forest products has seriously affected freight revenues. It is important to the future welfare of these railroads that they cooperate fully in any program that will return the forest lands of this area to full productivity. Paved Federal highways radiate from Lake Charles and Alexandria providing ample through routes. Inter-connecting gravelled roads link practically all of the settlements, but there are extensive areas that are 5 to 10 miles from a road. As most of the topography is gentle, these areas are accessible to logging trucks in dry weather.

The first permanent settlement in this unit was at Natchitoches, which the French established as a trading post in 1714. Extensive settlement throughout the region did not begin, however, until after 1800, when settlers from Mississippi, Alabama, Georgia, and the Carolinas gradually moved westward into Louisiana. Population increased slowly until about 1890, when the construction of railroads opened up vast tracts of virgin longleaf timber to the lumber industry. A few large sawmills were established between 1890 and 1900, but the majority came between 1900 and 1915. This expansion of industry resulted in a rapid increase in population. Sawmills and their communities began to be abandoned early in the century, with a consequent shifting of the population between parishes. In the decade between 1920 and 1930, there was a total decrease of nearly 10,000 in the population of Allen, Beauregard, and Vernon Parishes, while Calcasieu Parish, with its rice farming and gas and oil discoveries, gained over 9,000. According to the Bureau of the Census, the total population of the unit was about 202,000 in 1930, when 46 percent of the people lived on farms; 34 percent in small towns, sawmill villages, and lumber camps; and 20 percent in incorporated towns of more than 2,500 inhabitants. In 1935 the farm population was about 106,000, an increase of 13,000 since 1930. The Unemployment Census of 1937 showed that there were about 12,000 individuals totally unemployed, 4,000 employed on emergency work, and about 7,000 partly unemployed. With the lumber industry declining, and the acreage of certain agricultural crops being restricted, the maintenance of the present

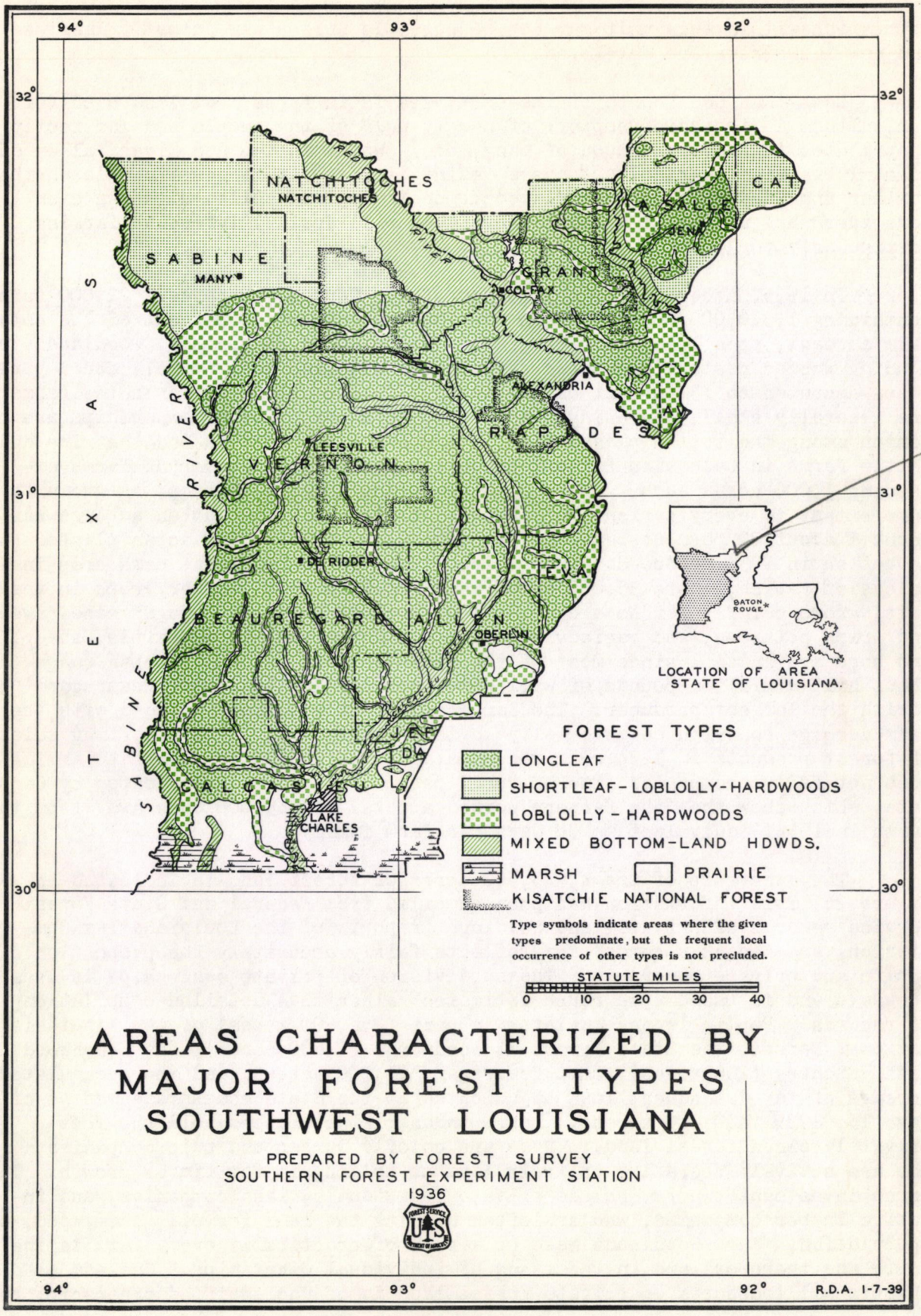


FIGURE 1 - FOREST TYPE MAP.

population within this unit may not be possible unless new forms of land use and new industries are developed.

Less than one-fourth of the unit area is in farms, but land used for agriculture is the chief support of nearly half of the people and indirectly contributes to the livelihood of many more. While in the Red River Valley and Coastal Prairies, agriculture has a definite place, it is questionable whether further unguided expansion should occur on the upland soils, although even here there are undoubtedly local areas that will justify intensive farming, particularly for truck crops.

In 1935, according to the Bureau of the Census, there were 22,000 farms containing 1,310,000 acres. Crops were harvested from 30 percent of the total farm acreage, open land used for grazing amounted to 15 percent, woodland (including wooded pasture) occupied 42 percent, and land used for all other purposes amounted to 13 percent of the total. In the upland parishes the farms are generally small, averaging about 50 to 60 acres. Larger ownerships are common among the cotton plantations in the Red River bottoms and the rice and cattle farms in Calcasieu Parish; these two areas contain over 50 farms exceeding 1,000 acres each. Cotton, which is the chief cash crop, is grown to some extent in every parish, but it is estimated that the cotton acreage was reduced about 20 percent between 1924 and 1934. The 109,000 acres planted to cotton in 1934 produced 52,000 bales. Rice is an important cash crop in Calcasieu Parish, where 35,000 acres were grown in 1934. Other crops in the unit, grown chiefly for home consumption, include corn, hay, sugar cane, sweet and Irish potatoes, and various vegetables. Large numbers of cattle, sheep, and hogs are raised, since most of the cut-over land is used as open range. About half a million pounds of wool were produced in 1934, with Beauregard Parish the largest producer. The large amount of woodland included with the farm acreage contributes materially to the farm income; farms reporting sales of forest products in 1934 received an average of $60.00 each. That farming does not fully occupy the time of rural people, however, is indicated by Census data, which show that the farmers worked a total of 665,000 days away from their farms in 1934, equivalent to 30 days per farm family.

The ownership of the 4,543,500 acres of forest land is indicated in figure 2. This information has been compiled from Federal and State Forest Service records of private-land holdings, reports of the Louisiana Tax Commission, and Census records, and reflects fairly accurately the proportion of public and private ownership. The subdivision of private ownerships is less accurate and is based upon rough estimates rather than detailed compilation of records. Public lands consist of a part (354,800 acres) of the Kisatchie National Forest, the State Forest at Woodworth (7,600 acres), the Beechwood Fish Hatchery (200 acres), Camp Beauregard (1,800 acres), and the accumulated acreage of tax-delinquent land adjudicated to the State and unredeemed as of Nov. 15, 1937 (440,000 acres). Large industrial operators hold the most privately owned forest land. These are chiefly lumber and pulp companies, who are actively operating on their land or holding it for timber growth. The large investment owners include private individuals, land companies, and inactive lumber companies, who are often holding the land for oil, stumpwood, or speculation. Farm woodlands make up a part of practically every farm in the unit, and therefore are in thousands of individual ownerships. One and a quarter million acres of private forest land is of unclassified ownership, but

a large majority is believed to be held by investment owners and small industrial operators in tracts ranging from a few acres to several thousand acres each.

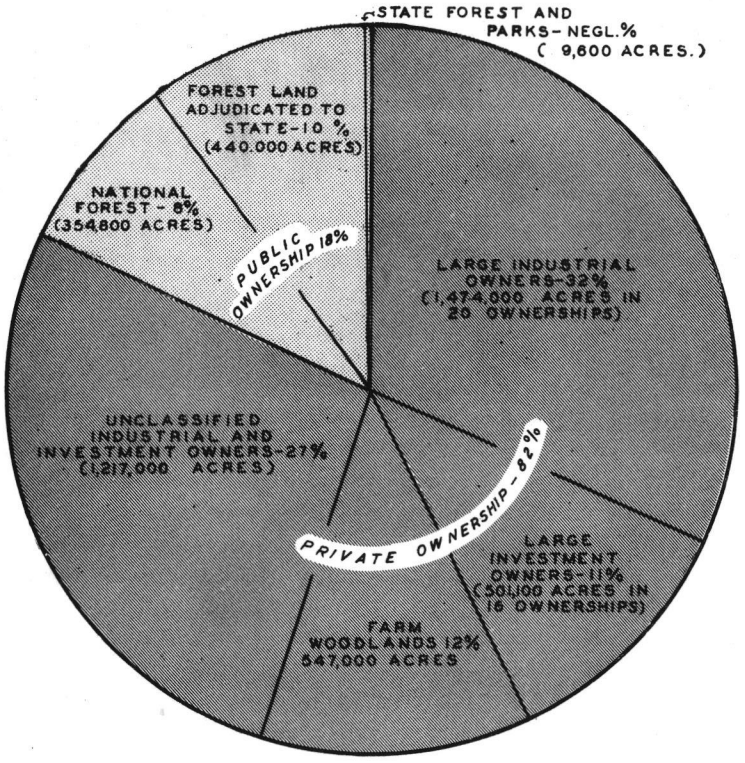

STATE FOREST AND PARKS - NEGL.% (9,600 ACRES.)
FOREST LAND ADJUDICATED TO STATE - 10 % (440,000 ACRES)
NATIONAL FOREST - 8% (354,800 ACRES)
PUBLIC OWNERSHIP 18%
LARGE INDUSTRIAL OWNERS-32% (1,474,000 ACRES IN 20 OWNERSHIPS)
UNCLASSIFIED INDUSTRIAL AND INVESTMENT OWNERS-27% (1,217,000 ACRES)
PRIVATE OWNERSHIP - 82 %
LARGE INVESTMENT OWNERS-11% (501,100 ACRES IN 16 OWNERSHIPS)
FARM WOODLANDS 12% 547,000 ACRES

FIGURE 2 - APPROXIMATE OWNERSHIP OF FOREST LAND IN SOUTHWEST LOUISIANA

For tax-assessment purposes forest land is classified by State and parish officials into several categories: woodland—brush woods that can not be classed as open land or timber land, including partially reforested cut-over lands; hardwood, pine, or cypress land—forest land supporting hardwood, pine, or cypress stumpage, respectively; reforestation land—lands set aside for reforestation purposes as provided by Act. No. 90 of 1922, Act No. 71 of 1924, and Act No. 121 of 1926; and cut-over land—all cut-over forest land not classified as woodland or reforestation land. According to the 1937 report of the Louisiana Tax Commission, the assessed value of woodland ranged from $3.68 in La Salle Parish to $12.18 in Calcasieu. On the areas classified as hardwood or pine land, the land is assessed at $2.00 to $3.00 per acre, and the standing timber at $3.12 to $6.00 per thousand board feet, resulting in assessed values per average acre ranging from $3.87 for pine land in Calcasieu Parish to $45.27 in Vernon. Hardwood land varied from $5.22 in Allen Parish to $44.29 in Calcasieu. Reforestation lands were assessed at $1.00 per acre in La Salle Parish and $3.00 per acre in Allen Parish. Forest land classified as cut over, either hardwood or pine, bears an assessment of $2.10 to $4.63 per acre. The average total State and parish tax rate was approximately 38 mills per dollar of assessed valuation. Taxes per acre

on land with timber varied from 13¢ in Calcasieu Parish to $2.51 on the old-growth stands in Vernon. The tax on cut-over land with little or no timber is 8 to 20¢ per acre. Approximately 460,000 acres of unredeemed land, both forest and agricultural, have been adjudicated to the State as of Nov. 15, 1937, for nonpayment of taxes; most of this is recently cut-over forest land in Natchitoches, Rapides, Calcasieu, and Vernon Parishes. In addition to the tax on land and standing timber, there is a severance tax that must be paid when the timber is cut. This varies with the species, being about 7 to 24¢ per M board feet, log scale, for hardwoods, 12¢ for pine, and 26¢ for cypress. The legal log rule is the Scribner-Doyle.

The most striking feature of table 1, which shows the land area of the unit classified according to land use, is the high proportion of the area in forest land. Small areas of new cropland occur chiefly in Sabine Parish, but this increase in new land is outweighed by land abandonment in Natchitoches, Sabine, Rapides, and Calcasieu Parishes. The excess of abandonment over new cropland is partially due to the large reduction in the acreage of cotton in these parishes between 1924 and 1934. About 20,000 acres of land were classified as abandoned in Calcasieu Parish, perhaps erroneously, as much of it is open prairie land that is used occasionally for grazing cattle. It is estimated that about half the idle and abandoned land shown in table 1 is in the uplands and suitable for timber production; the remainder is largely flat coastal prairie that may be less adapted for trees. Planting of forest-tree seedlings and intensive fire protection will be necessary for early and complete stocking in either case, and if present crop-control programs continue in effect, it is probable that many of these idle and abandoned acres will be available for timber production.

Table 1. - Land area classified according to land use, 1935

Land use	Area	Proportion of total area
	Acres	Percent
Forest:		
Productive	4,541,900	78.7
Nonproductive	1,600	negl.
Total forest	4,543,500	78.7
Nonforest:		
Agricultural:		
In cultivation:		
Old cropland	583,100	10.1
New cropland	34,300	.6
Out of cultivation:		
Idle	141,100	2.4
Abandoned	68,600	1.2
Pasture	96,700	1.7
Total agricultural	923,800	16.0
Other nonforest	306,900	5.3
Total nonforest areas	1,230,700	21.3
Total forest and nonforest	5,774,200	100.0

Description of the Forest

One of the finest longleaf pine forests in the South originally covered the uplands of this unit, while old-growth hardwoods of excellent quality occurred in the bottoms of the Sabine, Calcasieu, Red, and Little Rivers. At the turn of the century, however, large pine sawmills were established, and the process of clear-cutting the pine lands began. At present only a few large tracts of virgin pine and hardwood remain, and these are rapidly being cut. Vernon, Natchitoches, and Rapides Parishes contain most of the old-growth pine, while a greater part of the old-growth hardwood is in Vernon Parish in the Sabine River bottom lands. In the northern part of the unit, particularly in Sabine, Natchitoches, and La Salle Parishes, loblolly and shortleaf pine restocked large areas after the removal of the original stands (fig. 1). Extensive acreages of clear-cut longleaf land are in Grant and La Salle Parishes, but nearly a million acres of it lies in the central and southern parts of the unit. In the southwest portion of the unit there are some well-stocked stands of second-growth longleaf. Bottom lands along the larger streams contain a mixture of bottom-land hardwood species, chiefly red and black gums and water and white oaks. Scattered patches of hardwoods also occur on the uplands throughout the unit, with upland red oaks, scrub and post oaks, and hickories the more common species. The upland hardwoods, however, are much lower in quality than those of the bottom lands.

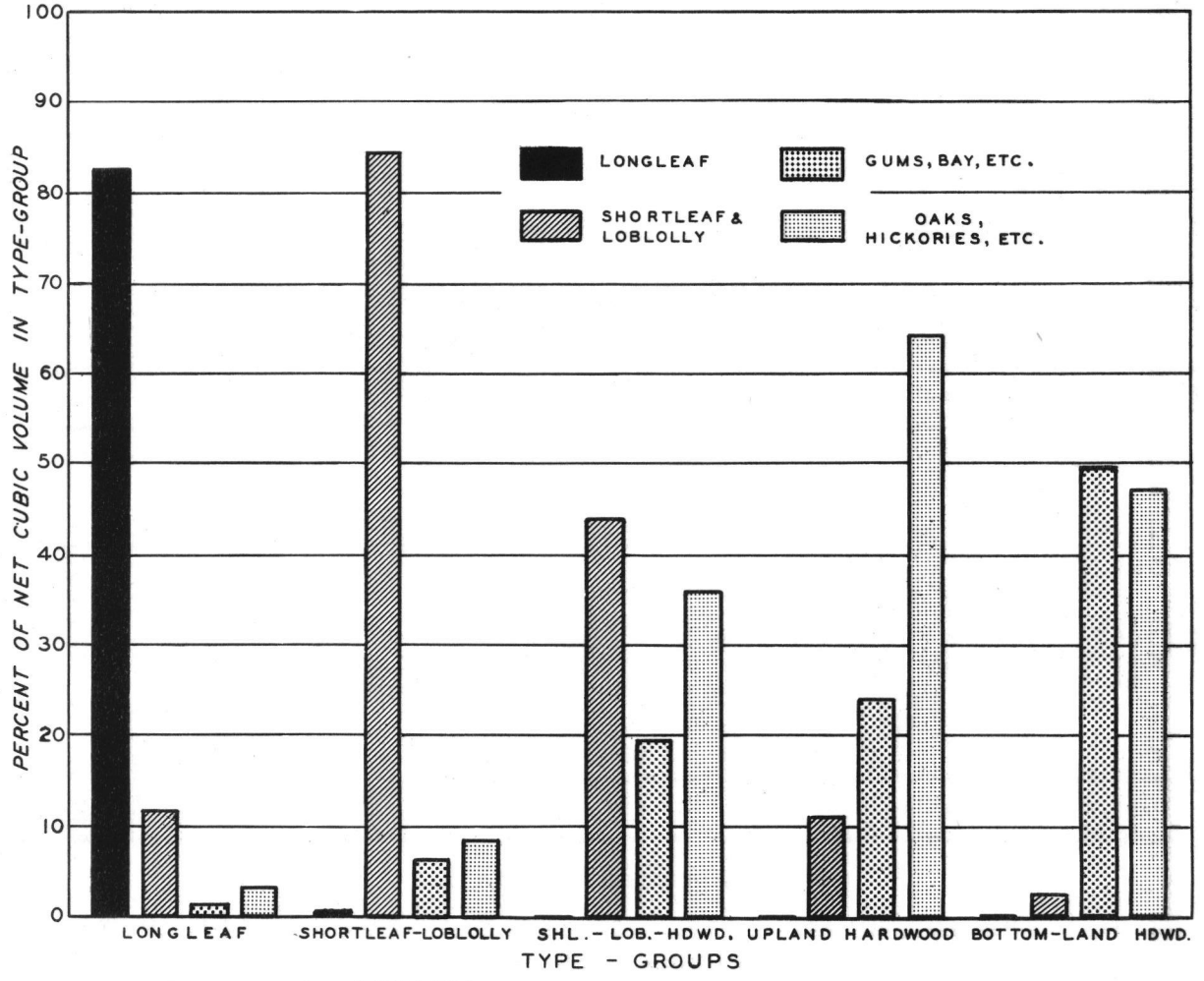
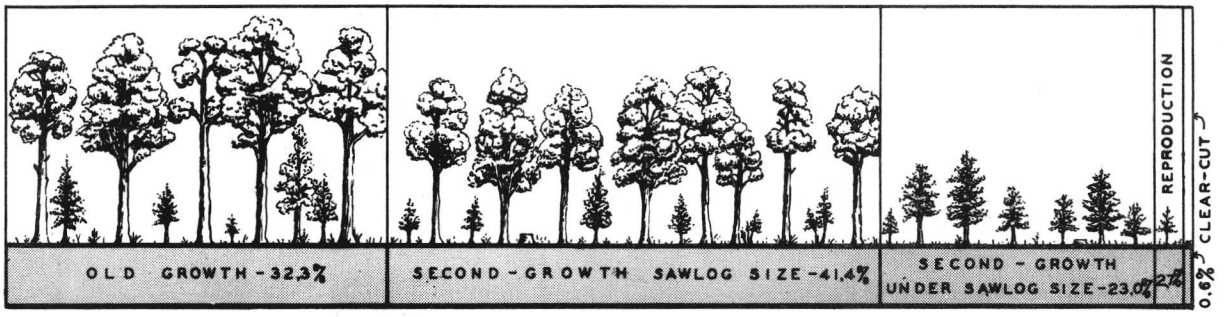


FIGURE 3.- SPECIES COMPOSITION OF FOREST TYPE-GROUPS.

Certain tree species are commonly associated, and this characteristic is the basis for classifying the forest stand into five major type-groups (see appendix): longleaf pine, shortleaf-loblolly pine, shortleaf-loblolly-hardwood, upland hardwood, and bottom-land hardwood. The species composition of each of the type-groups is shown in figure 3, in which the net cubic volume (bark included) in each species-group is expressed as a percentage of the total net cubic volume in the type-group. The species-groups as combined are: (1) longleaf pine; (2) shortleaf and loblolly pines; (3) red, black, and tupelo gums, with smaller quantities of cypress, bay, magnolia, maple, and cottonwood (the pulping hardwoods); and (4) oaks, beech, hickories, and elm (the hardwoods at present considered nonpulping).

Past cutting practices have influenced materially the character of the present forest cover. Logging has been in progress for over half a century, varying in intensity from absolute clear-cutting to the removal of selected trees only. The denuded areas have remained so, but second growth has become established over much of the forest land left in better condition. Age- and size-classes vary with the length of time since cutting, so that at present the forest land supports all stages of forest growth: clear-cut land, reproduction, young second-growth under sawlog size, merchantable second growth, and a remnant of the original old-growth stands. Figure 4 shows the proportionate area of the pine and hardwood type-groups in these various conditions. Very striking is the large area of clear-cut land in the pine types. Most of this area will require planting to restore the forest, since only 15 percent of it has even as many as three seed trees per acre.

A - PINE TYPES



B - HARDWOOD TYPES

FIGURE 4 - PROPORTIONATE AREA OF FOREST CONDITIONS IN THE PINE AND HARDWOOD TYPES.

In table 2 the area in the various forest conditions is presented by type-groups. More than half the longleaf area is clear-cut. About three-fourths of a million acres have restocked to second growth, but only recently, as reproduction and sapling sizes predominate. The small remaining area of old growth is being harvested rapidly, with part of the land left in good growing condition and part left denuded. Most of the shortleaf-loblolly and shortleaf-loblolly-hardwood stands are in the northern part of the unit on former longleaf land that was cut over when lumbering first started. Although this was only a little over 50 years ago, sufficient time has elapsed to produce timber stands of sawlog size on more than two-thirds of the area in these types.

Table 2. - Forest area classified according to forest condition and forest type-group, 1935

Forest condition	Longleaf	Shortleaf-loblolly	Shortleaf-loblolly-hardwoods	Upland hardwoods	Bottomland hardwoods	Total all types	Proportion of total
	Acres						Percent
Old growth:							
Uncut	58,500	5,500	7,000	22,600	122,400	216,000	4.8
Partly cut	64,700	9,300	11,700	25,700	173,900	285,300	6.2
Total	123,200	14,800	18,700	48,300	296,300	501,300	11.0
Second growth:							
Sawlog size:							
Uncut	187,100	416,400	231,500	51,400	194,900	1,081,300	23.8
Partly cut	59,300	198,000	167,600	60,800	134,900	620,600	13.7
Under sawlog size	383,500	194,100	199,600	111,500	134,100	1,022,800	22.5
Reproduction	153,500	34,300	15,600	18,800	10,100	232,300	5.1
Total	783,400	842,800	614,300	242,500	474,000	2,957,000	65.1
Clear-cut	1,055,600	21,000	800	800	5,400	1,083,600	23.9
Total all conditions	1,962,200	878,600	633,800	291,600	775,700	4,541,900	100.0
Percent of total forest area	43.2	19.3	14.0	6.4	17.1	100.0	

Nearly 30 percent of the area in the upland hardwood type-group consists of scrub hardwoods, which are found in scattered patches throughout the cut-over longleaf land. Since these species seldom attain merchantable size, they make up a large part of the area of under-sawlog-size upland hardwoods shown in table 2. More than half the total area of upland hardwoods is stocked with sawlog-size stands, but most of these have been cut over for the more valuable species. The bottom-land hardwood type-group contains the largest acreage of old-growth timber and also the highest proportion of sawlog-size

stands. Although about half the merchantable bottom-land hardwood stands have been culled by removal of the most valuable trees, a considerable volume of high-quality hardwood is still available.

The distribution of the total number of trees by size-classes is shown in figure 5. Noteworthy facts brought out by this diagram are: (1) hardwoods greatly exceed the pines in number; (2) longleaf pines make up a minor part of the total stand; (3) in the hardwoods there is an enormous number of 2-inch trees; and (4) in both pines and hardwoods the number of large trees is relatively small. Although there is an apparent surplus of smaller trees, a large part of these will die before reaching usable size. Fire protection is essential to reduce this mortality.

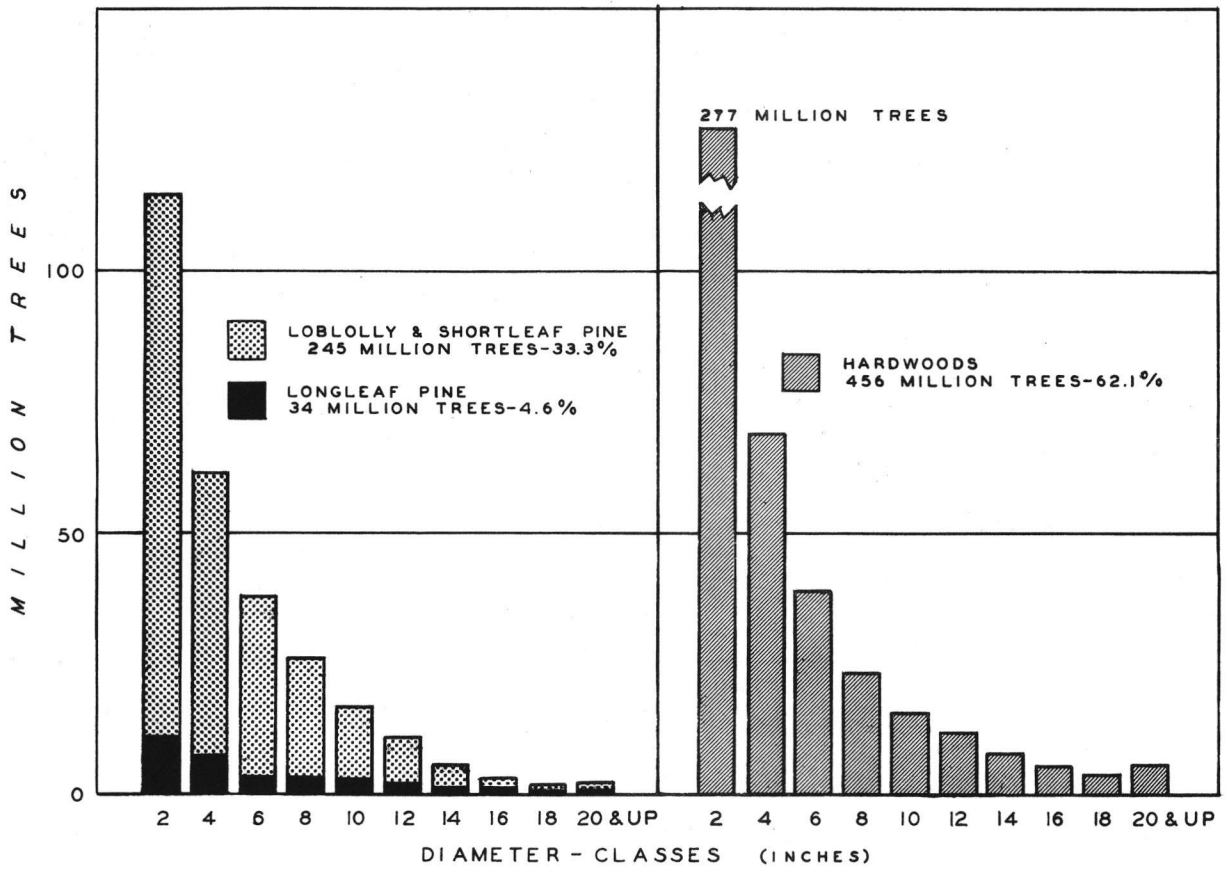


FIGURE 5 - STAND DIAGRAMS.

The portion of figure 6 designated as (A) represents the longleaf type area of 1,962,200 acres; while that designated as (B) represents the shortleaf-loblolly and shortleaf-loblolly-hardwood type areas combined, amounting to 1,512,400 acres. The total pine forest thus diagrammed occupies three-fourths of the forest land in the unit. The figure shows the age-class and volume distribution of the prevailing pine forest and contrasts the present volumes at various ages with the volumes that can be expected at comparable ages from well-stocked stands. The area and volume per acre of the existing age-classes was determined by a field survey of the $3\frac{1}{2}$ million acres in the

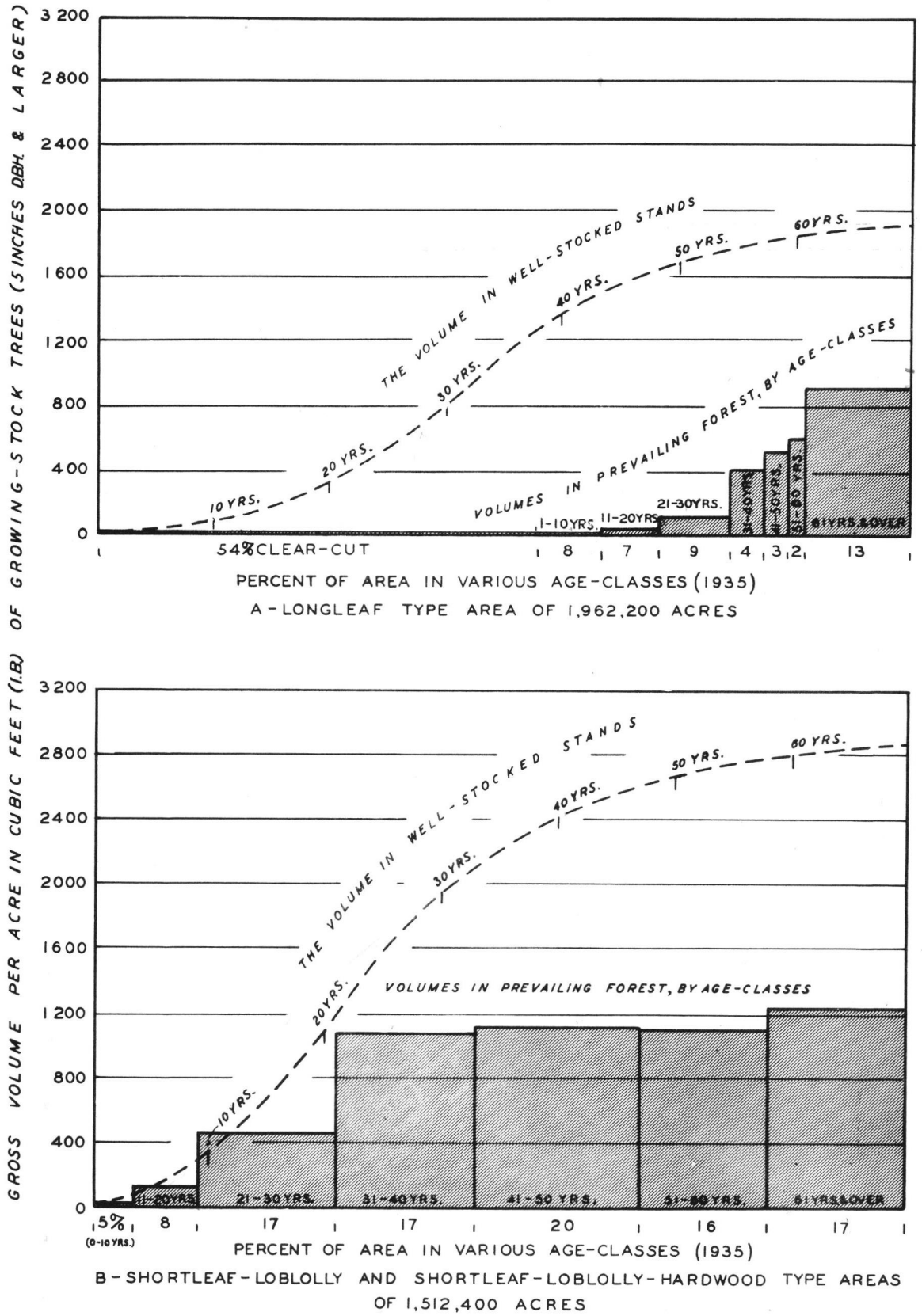


FIGURE 6 - DISTRIBUTION BY AREA OF PREVAILING AGE-CLASSES AND VOLUME, AND THE VOLUME IN WELL-STOCKED STANDS.

pine forest. The volume of well-stocked stands (shown by the broken line) is based upon the most heavily stocked 10 percent of the present uncut stands of weighted-average sites in these types. The deficiency in stocking of the prevailing forest is most obvious in the longleaf type area, but an opportunity for increasing the stocking on the remaining pine area is indicated for each age-class by the wide disparity between present volume and the volume attainable in well-stocked stands.

Planting will be necessary on about half of the longleaf area if the forest land is to be returned soon to productivity. Even though facilities were available to plant this large acreage immediately, it probably would require 4 to 5 million dollars for nursery stock and planting, and a wait of 20 to 30 years for the planted trees to reach pulpwood size (and even longer for them to reach saw-timber size). In addition, the elimination of fires would be necessary. Private industry is not likely to finance such an endeavor. Public acquisition, followed by planting, seems the probable answer.

The volume deficiency in the shortleaf-loblolly-hardwood forest can be improved greatly through intensive fire protection, since there is unutilized growing space in the present stand that will support a new crop of young trees if fire is eliminated. Present age-class distribution is favorable for sustained-yield operations, but it should be realized that the age-classes of the actual forest are much intermingled and not at all in even-aged blocks as shown in the figure.

It is apparent from figure 6 that there is an opportunity for greatly increased yields of wood products on a sustained-yield basis, if adequate forest-management practices are applied to the timber stands. In the early part of 1938, the Regional Office of the U. S. Forest Service at Atlanta, Ga., conducted a study of management practices throughout the Southern Region, visiting most of the larger industrial and investment owners. In southwest Louisiana, which is one of the worst cut-over areas in the South, the 36 owners visited were found to control nearly 2 million acres, or about 43 percent of the forest land. Figure 7 shows that 54 percent of the 2 million acres studied was being left in poor growing condition. Most of this land (over 1 million acres) has been cut so clean that planting will be necessary for the early establishment of forest cover, but indicative of the brighter side of the picture and of the growing trend in southern forestry was the discovery that 46 percent of the forest land visited was left in a productive condition, and that more than a half million acres were being managed for sustained yield.

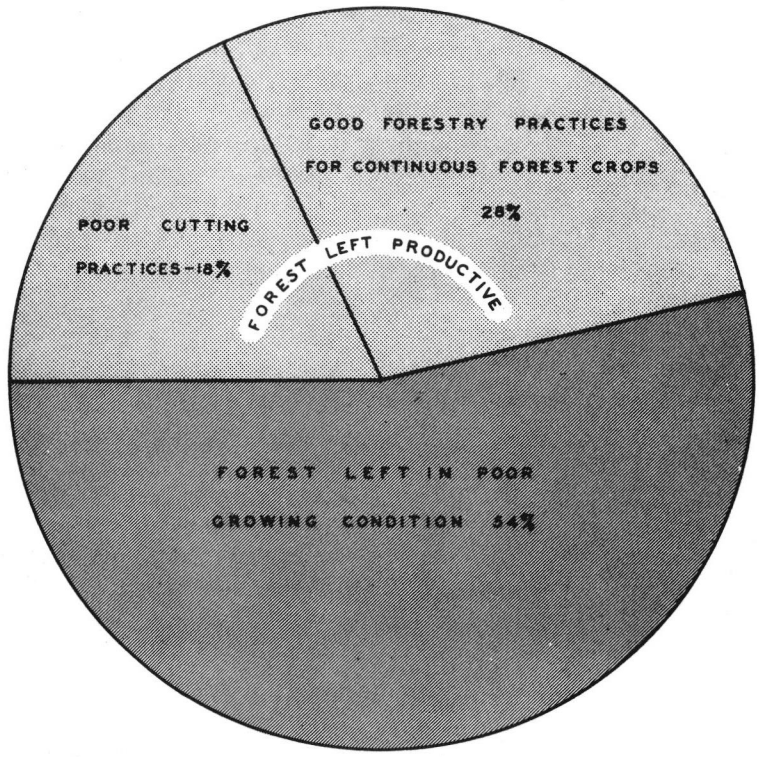


FIGURE 7 - MANAGEMENT PRACTICES ON PRIVATE FOREST LAND IN LARGE OWNER-SHIPS (BASED ON 1,975,100 ACRES.)

Volume Estimates

Board-foot volume

The estimate of the board-foot volume (definition in appendix) as of 1935 is given in table 3, expressed in terms of board feet as measured by the Doyle log rule. According to this table, the total volume is $6\frac{1}{2}$ billion board feet, almost equally divided between pines and hardwoods. About two-thirds of the pine volume is in second-growth stands. There is slightly over a billion board feet of old-growth pine, 82 percent of which is longleaf. Three-fourths of the total pine volume is in trees at least 13.0 inches d.b.h. In the hardwoods, the volumes in old-growth and second-growth stands are about equal. Although there are many trees of low quality, particularly in the upland hardwoods, about two-thirds of the hardwood volume is in trees that are 19.0 inches d.b.h. or larger and that contain a large proportion of high-quality material.

Additional information on the quality of both pines and hardwoods was gathered by supplemental studies. Trees in both the old-growth and second-growth conditions were graded. In the pines each tree was classified as "smooth," "limby," or "rough," while in the hardwoods the individual logs were classified as grade 1, 2, or 3. Descriptions of the classifications will be found in the appendix. The percentages given on page 15 are based upon the gross volume, lumber tally. The data show that the old-growth pine volume is practically all in "smooth" trees, whereas a considerable part of the volume in old-growth red gum and red oaks is in grade 3 logs. Shortleaf is the best of the second-growth pine species, while red gum has the highest proportion of volume in grade 1 among the second-growth hardwoods.

Table 3. - Net volume (Doyle) classified according to species-group and forest condition, 1935

Species-group	Old growth		Second growth		Total	Proportion of total
	Uncut	Partly cut	Sawlog size	Under sawlog size[1]		
	Thousand board feet					Percent
Pines:						
Longleaf	730,900	151,300	227,700	43,200	1,153,100	17.7
Shortleaf	23,700	38,200	506,600	12,500	581,000	9.0
Loblolly	91,500	46,500	1,243,500	26,700	1,408,200	21.6
Total pines	846,100	236,000	1,977,800	82,400	3,142,300	48.3
Pulping hardwoods:						
Red gum	226,000	186,600	342,100	7,900	762,600	11.7
Black gum	162,200	137,100	149,500	7,300	456,100	7.0
Others, incl. cypress	86,500	57,400	79,800	6,700	230,400	3.5
Nonpulping hardwoods:[2]						
Red oaks	142,200	132,900	331,100	12,800	619,000	9.5
White oaks[3]	104,300	133,000	331,700	9,300	578,300	8.9
Ash	19,200	9,300	25,100	1,700	55,300	.8
Others[4]	172,000	169,800	313,000	11,700	666,500	10.3
Total hardwoods	912,400	826,100	1,572,300	57,400	3,368,200	51.7
Total all species	1,758,500	1,062,100	3,550,100	139,800	6,510,500	100.0
Percent of total	27.0	16.3	54.6	2.1	100.0	

1/ Includes reproduction and clear-cut.
2/ Includes species not commercially pulped at present, although some have been used experimentally.
3/ Approximately 26 percent of this volume is post oak.
4/ Approximately 28 percent of this volume is hickory.

	Old-growth trees			Second-growth trees		
	Smooth	Limby	Rough	Smooth	Limby	Rough
Longleaf pine	100	negl.	-	89	11	negl.
Shortleaf pine	100	negl.	-	98	2	-
Loblolly pine	No data			67	26	7

	Old-growth logs			Second-growth logs		
	Grade 1	Grade 2	Grade 3	Grade 1	Grade 2	Grade 3
Red gum	79	2	19	69	8	23
Red oaks	62	14	24	53	10	37
White oaks	No data			63	7	30

The volumes given in table 4 are obtained by using the International $\frac{1}{4}$-inch rule, which is used throughout this report as the equivalent of green lumber tally. It therefore gives a more accurate expression of the recoverable volume in the forest stand than the Doyle rule, which under-scales small logs and over-scales large ones. A comparison of tables 3 and 4 shows that the lumber tally volume exceeds the Doyle volume by 47 percent.

Table 4. - Net volume, lumber tally, classified according to species-group and forest condition, 1935

Species-group	Old growth		Second growth		Total
	Uncut	Partly cut	Sawlog size	Under sawlog size 1/	
	- - - - Thousand board feet (green lumber tally) - - -				
Pines:					
Longleaf	931,100	212,700	422,500	94,000	1,660,300
Loblolly and shortleaf	157,300	123,600	3,118,800	87,200	3,486,900
Total pines	1,088,400	336,300	3,541,300	181,200	5,147,200
Hardwoods:					
Gums, etc.	608,900	491,700	814,400	37,800	1,952,800
Oaks, etc.	531,300	555,800	1,347,400	53,700	2,488,200
Total hardwoods	1,140,200	1,047,500	2,161,800	91,500	4,441,000
Total all species	2,228,600	1,383,800	5,703,100	272,700	9,588,200

1/ Includes reproduction and clear-cut conditions.

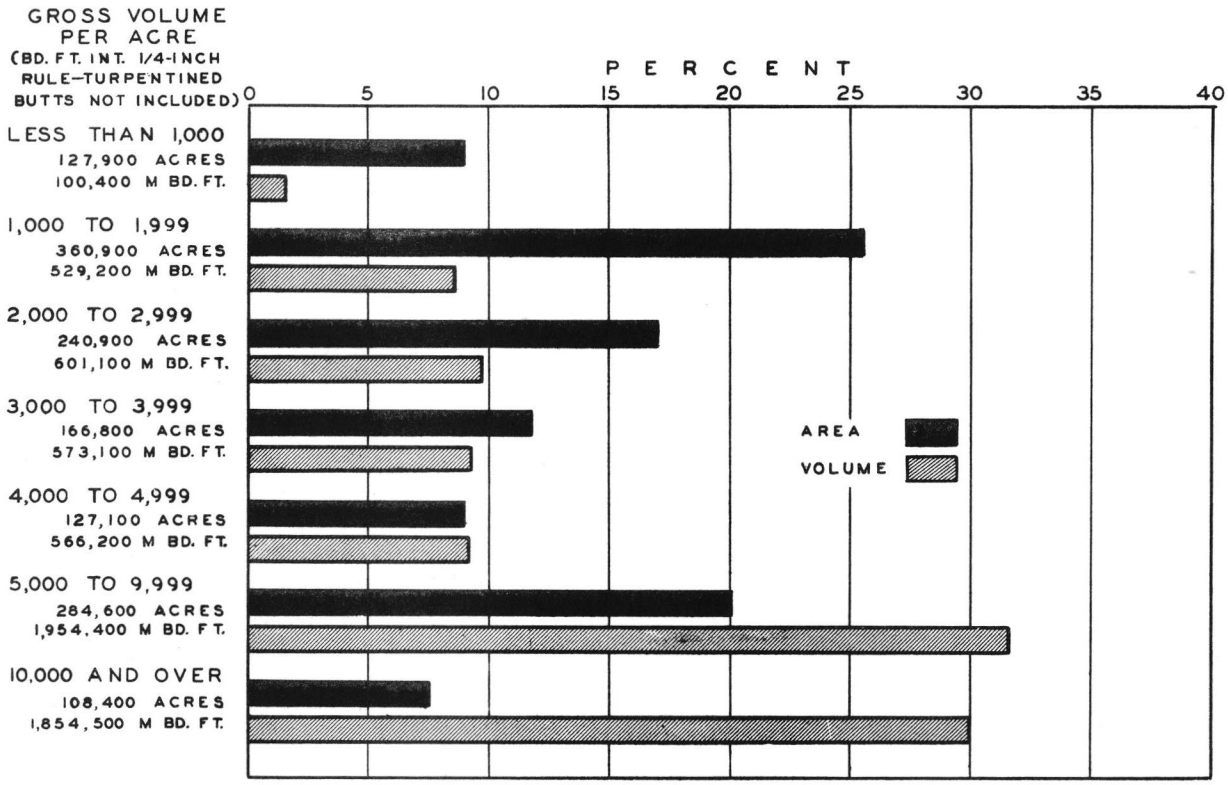
The old-growth condition occupies only 11 percent of the forest area (table 2), but it contains 38 percent of the total board-foot volume (table 4). Volumes per acre are high, averaging 10,300 board feet lumber tally, for all types in old-growth uncut stands. In the various type-groups of the old-growth uncut condition, the average stands per acre are as follows: longleaf, 16,600 board feet; shortleaf-loblolly, 12,000; shortleaf-loblolly-hardwoods, 10,500; upland hardwoods, 3,800; and bottom-land hardwoods, 8,500 board feet.

The second-growth condition, including reproduction, occupies 65 percent of the forest area and contains almost 62 percent of the board-foot volume. Second-growth stands have less volume per acre than those in the old-growth condition, averaging 3,800 board feet for all types in the second-growth uncut sawlog-size condition. There is considerable variation between type-groups in this condition, as the average stand per acre in the longleaf is 2,300 board feet; in the shortleaf-loblolly, 4,700; in the shortleaf-loblolly-hardwoods, 3,700; in the upland hardwoods, 2,800; and in the bottom-land hardwoods, 3,800 board feet.

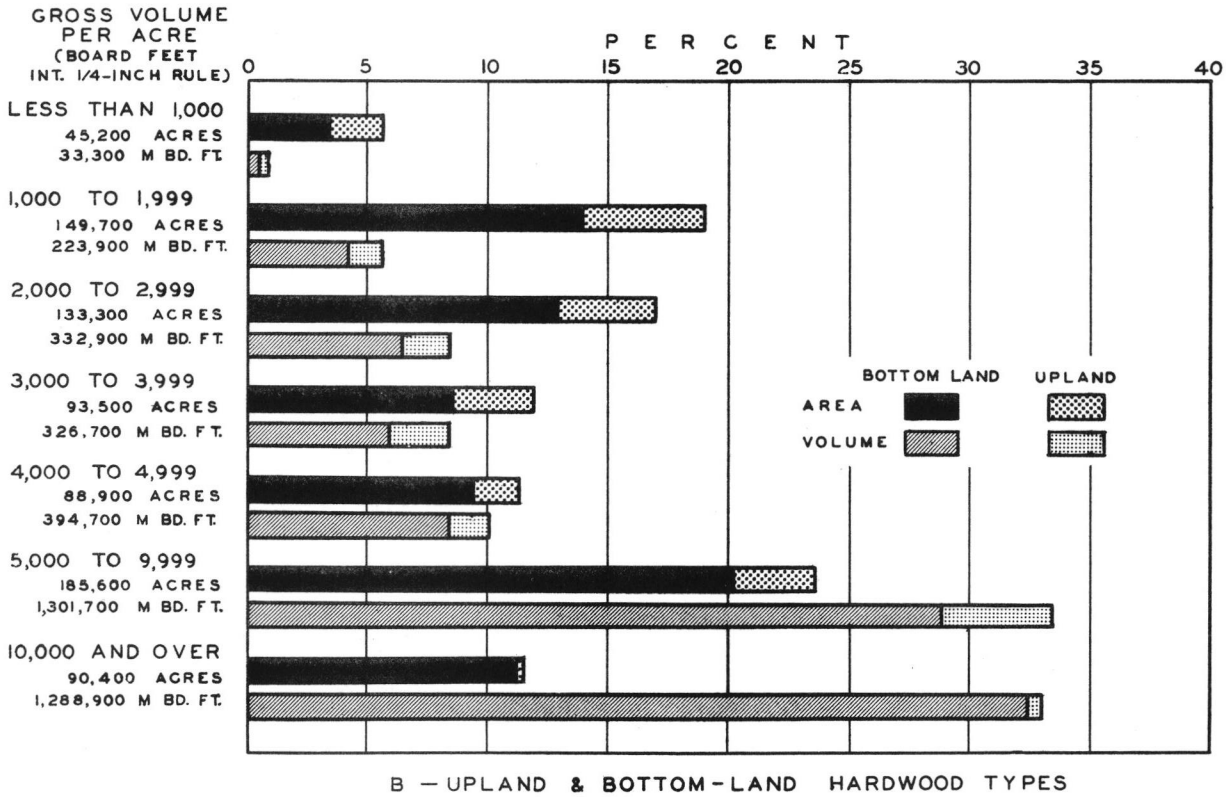
About 24 percent of the forest area is in the clear-cut condition, but this large area of more than a million acres contains only a negligible part of the total board-foot volume. The average stand per acre is 40 board feet.

Figure 8 is included to show the distribution of the volume in the sawlog-size conditions of the pine and hardwood type-groups. The total volume shown in the two portions of the figure is gross and exceeds the volume given in table 4 because cull has not been deducted. In the pine types, 90 percent of the volume is in stands of 2,000 or more board feet per acre, such stands occurring on 65 percent of the area. Stands of at least 10,000 board feet per acre contain 30 percent of the total pine volume, which is concentrated on 108,000 acres. These figures, which are based upon the 1935 inventory, however, do not portray exactly the 1938 situation, inasmuch as cutting has been continuous in these old-growth stands. In the hardwood types, 93 percent of the volume is in stands of 2,000 or more board feet per acre, with 75 percent of the area supporting these more-heavily stocked stands. Volumes of at least 10,000 board feet per acre occur on 11 percent of the hardwood area and account for 33 percent of the total hardwood volume.

The bottom-land hardwood types exceed those of the uplands in concentration of volume, and 95 percent of the bottom-land hardwood volume is in stands of 2,000 feet or more per acre, compared with 86 percent of the upland hardwood volume. Furthermore, 37 percent of the bottom-land hardwood volume is in stands of at least 10,000 board feet per acre, whereas only 5 percent of the upland hardwood volume is in such heavy stands.



A — LONGLEAF, SHORTLEAF-LOBLOLLY, AND SHORTLEAF-LOBLOLLY-HARDWOOD TYPES



B — UPLAND & BOTTOM-LAND HARDWOOD TYPES

FIGURE 8 — PROPORTIONAL AREA AND VOLUME OF THE SAWLOG-SIZE CONDITIONS, CLASSIFIED ACCORDING TO VOLUME OF SAW TIMBER PER ACRE.

Cordwood volume

The estimate of cordwood volume (see detailed description in appendix) as of 1935, shown in table 5, includes the entire stand of sound trees at least 5.0 inches d.b.h. outside bark, and in addition the net sound volume in cull trees 5.0 inches d.b.h. or larger. These volumes are expressed in terms of standard cords (4 x 4 x 8 feet), estimated to contain 90 cubic feet of pine or cypress, or 80 cubic feet of hardwood, all including bark.

Shortleaf and loblolly make up three-fourths of the pine volume; and longleaf, the remainder. Almost 77 percent of the total pine volume is in trees 9.0 inches and larger. About 9-3/4 million cords are in trees 5.0 to 12.9 inches d.b.h.; 85 percent of the volume in these smaller trees is in shortleaf and loblolly pine. Stands of these species are most widespread in Sabine and Natchitoches Parishes. The pulping hardwoods are chiefly red, black, and tupelo gums, which are most abundant in the larger river bottoms. Twenty-eight percent of the total volume in the pulping hardwood species is in sound trees below sawlog size. There is also a large volume of hardwoods that are considered nonpulping at present but that eventually may be useful for pulp; post and scrub oaks already are being used in small amounts for experimental purposes.

Table 5. - Net volume of all sound material, expressed in cords of wood with bark, 1935

Species-group	Source of material				Total all classes	Proportion of total
	Sound trees sawlog size	Upper stems of sawlog-size trees	Sound trees under sawlog size	Cull trees		
	Cords					Percent
Pines	11,253,200	2,081,400	4,050,800	131,400	17,516,800	36.4
Hardwoods:						
Pulping	4,837,900	2,491,800	3,653,900	1,936,500	12,920,100	26.9
Nonpulping	5,688,800	3,395,300	5,039,400	1/ 3,556,100	17,679,600	36.7
Total hardwoods	10,526,700	5,887,100	8,693,300	5,492,600	30,599,700	63.6
Total all species	21,779,900	7,968,500	12,744,100	5,624,000	48,116,500	100.0
Percent of total	45.2	16.6	26.5	11.7	100.0	

1/ Includes sound scrub oak.

The cordwood volume of sound-tree growing stock is shown in figure 9, classified according to species-group and diameter-class. Sound-tree volume as used here includes the full stems of pines and hardwoods under sawlog size but at least 5.0 inches d.b.h., the full stems of merchantable pines to a variable (minimum 4-inch) top, and the saw-timber portion of sawlog-size hardwoods. The volume in cull trees, scrub oaks, and tops and limbs of sawlog-size hardwoods is not included.

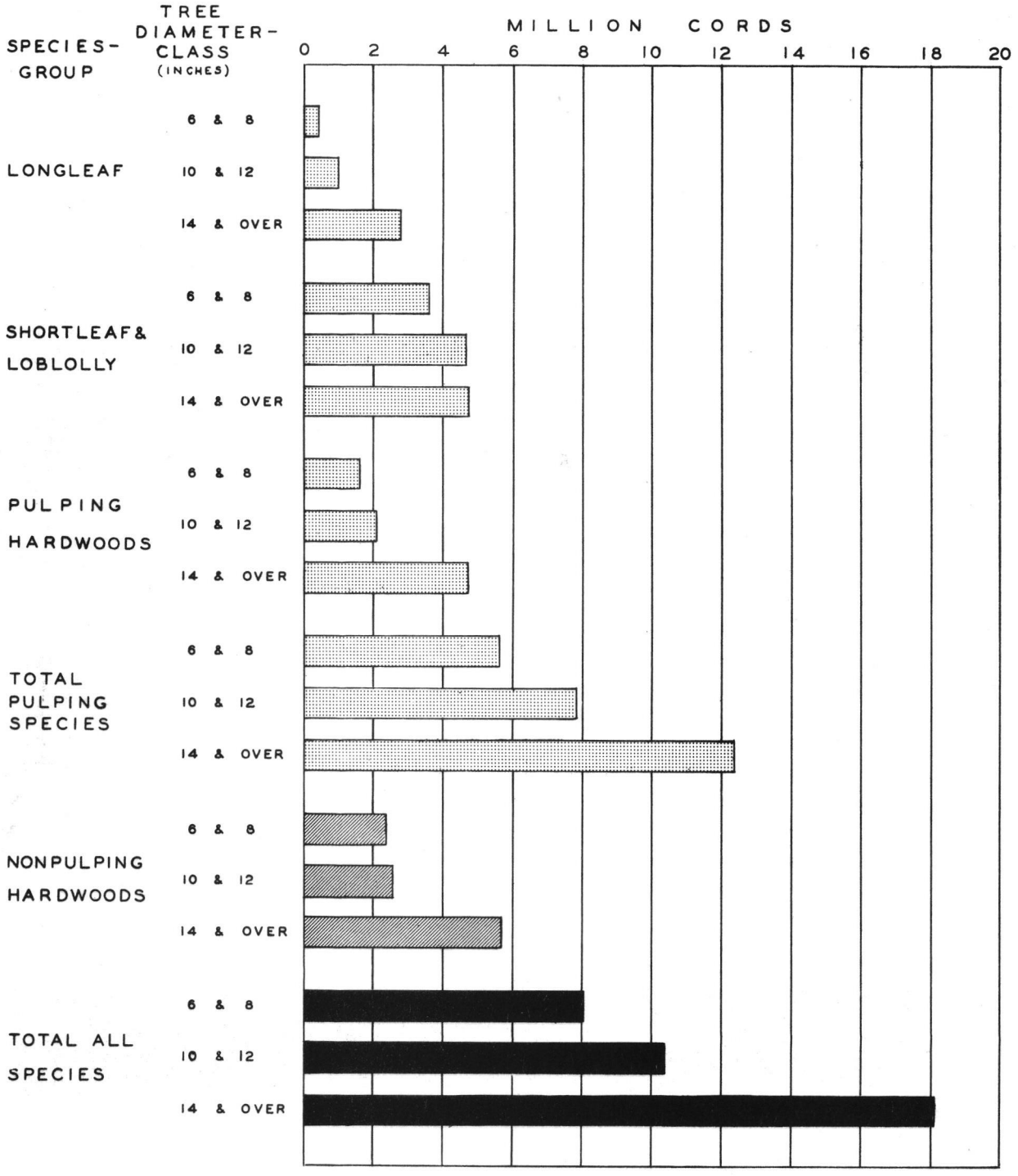


FIGURE 9 - CORDWOOD VOLUMES OF PULPING AND NONPULPING SPECIES.

Pine poles and piles [1/]

Many of the pine trees included in the tables of volume shown earlier in this report are suitable for use as poles or piles. Their number, classified by size and length, is given in table 6, where the preponderance of shorter and smaller trees is apparent. Technicians drawing up pole or pile specifications should note that there are four times as many 30-foot pieces as 35-foot ones. Liberalizing the specifications where possible will greatly increase the supply of pole and pile timber, and will provide one way of meeting the competition of the growing pulp industry.

Table 6. - Total number of pine poles or piles, classified according to length and diameter, 1935

D.B.H. of trees (outside bark)	Pole or pile length (feet)							Total	Proportion of total
	20	25	30	35	40	45	50 or over		
Inches	Thousand pieces								Percent
7.0 - 8.9	1,884	542	361	20	-	-	-	2,807	30.4
9.0 - 10.9	1,368	616	614	150	146	-	-	2,894	31.3
11.0 - 12.9	728	458	508	164	97	69	28	2,052	22.2
13.0 - 14.9	263	228	282	86	45	39	45	988	10.7
15.0 - 16.9	83	91	117	43	18	11	24	387	4.2
17.0 - 18.9	22	27	34	16	4	3	6	112	1.2
Total	4,348	1,962	1,916	479	310	122	103	9,240	100.0
Percent of total	47.1	21.2	20.7	5.2	3.4	1.3	1.1	100.0	

Wood naval stores

The clear-cutting of longleaf stands that has been in progress since 1890 has left a vast reservoir of stumpwood that can be utilized by the wood naval stores industry. One steam and solvent plant has been operating in this area for about 20 years, but its reduction of the total supply is not very apparent. It is estimated that there are 1,412,400 acres on which stumps are commercially available at present. In addition, there are 630,000 acres (containing about 2 million tons of stumps), upon which stumps are at present unavailable because they are (a) in thick stands of second-growth timber or (b) freshly cut and consequently unseasoned. Nearly 87 percent of the stumpwood area now operable contains 6 or more stumps per acre, and 34 percent contains 26 or more per acre.

The tonnage of merchantable stumps on a blasting basis (5 stumps per ton) is presented in table 7. These stumps occur in all the forest conditions,

1/ For additional information, see "Pole and Pile Timber in the Pine-Hardwood Region-West," Forest Survey Release #28, Southern Forest Exp. Station, New Orleans, La., Sept. 25, 1937.

and all are available according to present methods of operation. Theoretically this total volume of about 6 million tons is sufficient to support 4 steam and solvent plants, each using 75,000 tons of wood annually, for the next 20 years. Calculated on the basis of yields obtained from other steam and solvent operations, these four plants could produce annually 39,000 barrels (50 gallons each) of turpentine, 250,000 barrels (500 pounds gross each) of rosin, and 1.9 million gallons of pine oil, as well as other chemical products. At present several factors make immediate and full utilization of these wood supplies impractical, for the output of sulphate wood turpentine is steadily increasing, substitute materials are narrowing the market, and the gum naval stores industry is in a chaotic financial condition because of overproduction. It would be good economy, however, to use these stumps before they are wasted through fire and decay. A program of research that will develop new uses for all naval stores, coupled with more conservative practices in the gum naval stores industry, e.g., chipping only sawlog-size trees, might allow a more balanced and profitable production of both wood and gum naval stores.

Table 7. - Weight of merchantable longleaf pine stumps removable by blasting, classified according to forest condition and number of stumps per acre, 1935

Stumps per acre	Old growth	Second growth			Clear-cut	Total	Proportion of total
		Sawlog size	Under sawlog size	Reproduction			
	Thousand tons						Percent
5 or less	6	11	15	6	37	75	1.2
6 to 13	12	72	168	48	281	581	9.6
14 to 25	75	119	321	166	1,160	1,841	30.4
26 or more	100	145	374	253	2,690	3,562	58.8
Total	193	347	878	473	4,168	1/6,059	100.0
Percent of total	3.2	5.7	14.5	7.8	68.8	100.0	

1/ If mechanical stump pullers were used, the total recoverable volume would be about 10 million tons.

Gum naval stores

The gum naval stores industry in this area has been based almost entirely upon old-growth longleaf pine. This class of timber is now almost gone, and the naval stores industry is vanishing with it. During the 1937 season, there was only one active turpentine operation. Old-growth timber, located in Vernon and Rapides Parishes, was being worked in advance of logging.

It is difficult to estimate the part that second-growth longleaf may play in future naval stores production in this unit. Field observations indicate that south and west of DeQuincy there is an extensive body of second-growth longleaf that soon may be suitable for turpentining, but Survey data

are not localized enough to warrant estimates of the number of stems per acre and the total round-timber acreage in this locality. Data gathered for the entire unit show that in 1935 there were about 4½ million round second-growth longleaf pine trees (9.0 inches d.b.h. and larger) in the longleaf pine type, estimated to have about 5 million future faces, but probably a large majority of these trees are so scattered that naval stores operations would be impractical.

Forest Increment

Throughout this report the term "forest increment" is used to denote the net volume of wood created by growth of the forest growing stock. In all the tables dealing with forest increment, except table 11, the calculations for each year are based upon (1) the growth of the sound trees that remained in the stand, (2) the growth produced by trees previous to their being harvested, (3) the volume of those trees that came into measurable size, and (4) the volume lost because of mortality, rot, and other natural causes. Increment on cull trees and limbs of all species, however, is omitted. The board-foot increment includes the growth on the saw-timber portion of sawlog-size trees. The cordwood increment, which includes bark in all cases, is the growth on the sound stemwood of pines 5.0 inches d.b.h. and over, on under-sawlog-size hardwoods, and on the sawlog portion of sawlog-size hardwoods. Cubic-foot volumes are for wood without bark; otherwise, the material is identical with that included in the cordwood tables.

The increment of the forest stand for 1935 is shown in table 8. This is the latest year for which increment can be presented accurately by forest conditions, as the changes in the area of these conditions, due to cutting and growth, have not been determined since the inventory was made.

Owing to the fact that all the pine species are grouped together in the old-growth condition, table 8 fails to emphasize properly the retrogression of the old-growth longleaf stands. Long since mature, the loss in these stands from mortality and decay exceeded the gain through growth by over 5 million board feet, whereas the less mature stands of old-growth shortleaf and loblolly increased 3 million board feet through growth. Obviously rapid utilization of the mature and over-mature trees in the old-growth longleaf stands is desirable to keep the volume lost through mortality at a minimum, but it is likewise desirable that the cutting methods used should insure the continued productivity of the forest land.

The total increment of 487,500 board feet represents a volume increase of more than 5 percent during the year. About two-thirds of the total board-foot increment is in the pine species, owing to a greater growth rate and a larger growing stock in this species-group. Eighty-three percent of the pine increment is in sawlog-size stands and is available for sustained-yield utilization at the present time. It would be good practice, however, to reserve a portion of this increment for building up the growing stock, as the pine stands are both understocked and overcut. In the hardwoods, 89 percent of the increment is in sawlog-size stands, but some of this is in low-quality species that are commonly not logged in commercial operations.

Table 8. - Forest increment in board feet and cubic feet in the various forest conditions, 1935

Forest condition	Saw-timber material			All material		
	Pine	Hardwood	Total	Pine	Hardwood	Total
	Thousand board feet			Thousand cubic feet (i.b.)		
Old growth	-2,300	55,600	53,300	740	10,530	11,270
Second growth:						
Sawlog size	264,300	98,900	363,200	55,430	27,780	83,210
Under sawlog size	48,200	18,500	66,700	15,780	8,380	24,160
Reproduction and clear-cut	4,200	100	4,300	1,040	530	1,570
Total all conditions	314,400	173,100	487,500	72,990	47,220	120,210

The cubic-foot increment above is expressed in standard cords (4 x 4 x 8 feet) in table 9. The volumes given include both wood and bark, since this is the usual commercial practice in the pulpwood industry in the South.

Table 9. - Forest increment in cords of wood with bark in the various forest conditions, 1935

Forest condition	Pine	Hardwood	Total
	Cords		
Old growth	9,800	154,400	164,200
Second growth:			
Sawlog size	728,200	421,200	1,149,400
Under sawlog size	215,100	131,400	346,500
Reproduction and clear-cut	13,700	8,200	21,900
Total all conditions	966,800	715,200	1,682,000

The increment in board feet and cubic feet is shown in table 10 for each of the 3 years since the inventory of 1935. The values for 1937 are used in the comparison of increment and drain in tables 14 and 15 in order to portray the growing-stock situation on Jan. 1, 1938.

Table 10. - Forest increment in board feet and cubic feet in 1935, 1936, and 1937

Year	Saw-timber material			All material		
	Pine	Hardwood	Total	Pine	Hardwood	Total
	-- Thousand board feet --			- Thousand cubic feet (i.b.) -		
1935	314,400	173,100	487,500	72,990	47,220	120,210
1936	323,600	168,600	492,200	76,360	47,660	124,020
1937	329,000	170,300	499,300	78,000	48,240	126,240

Increment per acre of uncut stands

The growing power of the various forest conditions in 1935 is illustrated in table 11. The values revealed here are based upon the 1935 inventory, and since they are given in order to show the relative growth rates of various forest conditions and species-groups, the estimated full year's growth on harvested trees has been included.

Table 11. - Average increment per acre in the various forest conditions undisturbed by cutting in 1935

Forest condition	Pine component			Hardwood component			Total per acre		
	Bd.ft.	Cu.ft. 1/	Cords	Bd.ft.	Cu.ft. 1/	Cords	Bd.ft.	Cu.ft. 1/	Cords
Old growth:									
Uncut	-34	-4.1	-.05	126	19.0	.27	92	14.9	.22
Partly cut	21	6.4	.08	107	23.6	.35	128	30.0	.43
Second growth:									
Sawlog size:									
Uncut	194	40.4	.53	62	17.3	.26	256	57.7	.79
Partly cut	103	21.6	.28	53	15.1	.23	156	36.7	.51
Under sawlog size	47	15.6	.21	18	8.2	.13	65	23.8	.34
Reproduction and clear-cut	3	0.8	.01	negl.	0.4	.01	3	1.2	.02
Weighted averages	71	16.5	.22	39	10.5	.16	110	27.0	.38

1/ Inside bark.

Forest Industries

Sawmills

The lumber industry became important in this area soon after 1890. Since that time many large sawmills, with their accompanying effects upon community development, have come and gone. For instance, in Vernon and Beauregard Parishes, 16 large sawmills that began operation between 1898 and 1920 had cut out and were completely abandoned by 1933. Most of these mills employed about 400 men each and maintained towns of at least 1,000 people.

Although the lumber industry has passed its heyday, in 1937 there were in the area 95 active sawmills (table 12), producing 449 million board feet of lumber, which included at least 270,000 sawn cross ties. About 72 percent of this was pine and the remainder, mixed hardwoods. About 40 percent of the pine cut was from old-growth timber and 60 percent from second growth, but about 90 percent of the hardwood lumber was cut from old-growth stands. Only 63 million board feet of the total lumber production was cut from saw timber brought into the unit from the outside, and this was nearly balanced by the 51 million board feet of saw timber shipped to sawmills outside the unit.

Table 12. - Number of sawmills, lumber production, and extent of employment, classified according to size of mill, 1937

Rated capacity[1/] (10-hour day)	Number of sawmills	Lumber production			Employment provided		
		Pine	Hardwood	Total	In woods	In mill	Total
Thousand board feet		- Thousand board feet -			- Thousand man-days -		
Under 20	69	31,800	1,000	32,800	28	52	80
20 to 39	3	21,100	4,700	25,800	61	42	103
40 to 79	11	44,800	66,700	111,500	176	243	419
80 and over	12	223,800	54,900	278,700	250	617	867
Total	95	321,500	127,300	448,800	515	954	1,469

1/ Rated capacity indicates size of mill rather than actual average daily production.

Sawmills with a rated capacity of less than 40,000 board feet per 10-hour day are most numerous (fig. 11), but they produced only 13 percent of the lumber cut. The mills of a daily capacity of 40,000 to 79,000 board feet produced 25 percent of the lumber, while 62 percent was cut by the 12 large mills having a capacity of 80,000 or more board feet per day. The cutting capacity of the 95 mills listed in table 12 is 2.45 million board feet per 10-hour day, or a yearly cut of 612.5 million board feet, on the basis of 250 days per year. The 1937 lumber production was about three-fourths of this computed capacity.

The total production of the sawmills for 1937 in each complete or partial parish is shown graphically in figure 10. Most of the logs contributing to the production of a parish were cut within it, but a few of the larger sawmills drew material from a much wider area.

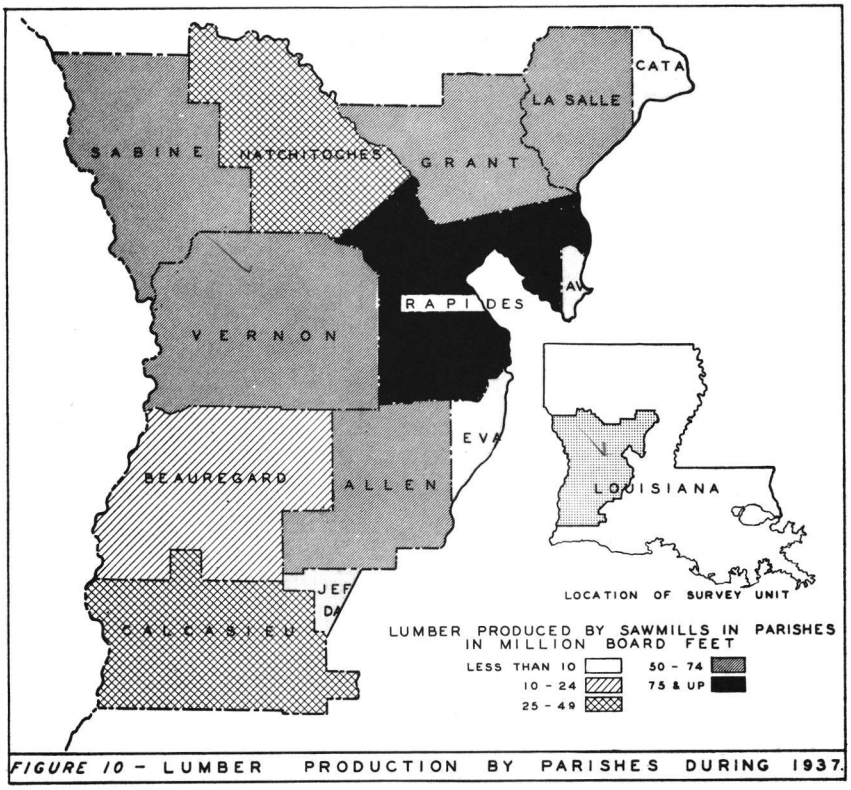


FIGURE 10 - LUMBER PRODUCTION BY PARISHES DURING 1937.

Other forest industries

The lumber industry greatly exceeds the other forest industries in number of plants, wood requirements, and employment provided. There is, however, some activity in practically all kinds of forest utilization common to the South. The largest of the other forest industrial establishments, as measured in terms of labor required to operate it, is the wood distillation plant at De Quincy, which uses the steam and solvent process in the conversion of old-growth longleaf pine stumps and "light wood." A sulphate pulp mill at Elizabeth also secures all its timber from this unit.

Two treating plants, one at De Ridder and one at Colfax, were in operation in 1937. A third plant, constructed at De Ridder in 1937, began operation early in 1938. Among the smaller manufacturing establishments are 4 shingle mills, 3 cooperage plants, 1 handle plant, 1 hardwood dimension plant, and 1 gum turpentine still (fig. 11). These 14 plants operating in 1937 required 142,000 man-days of labor for the manufacture of the raw material after it was delivered to them.

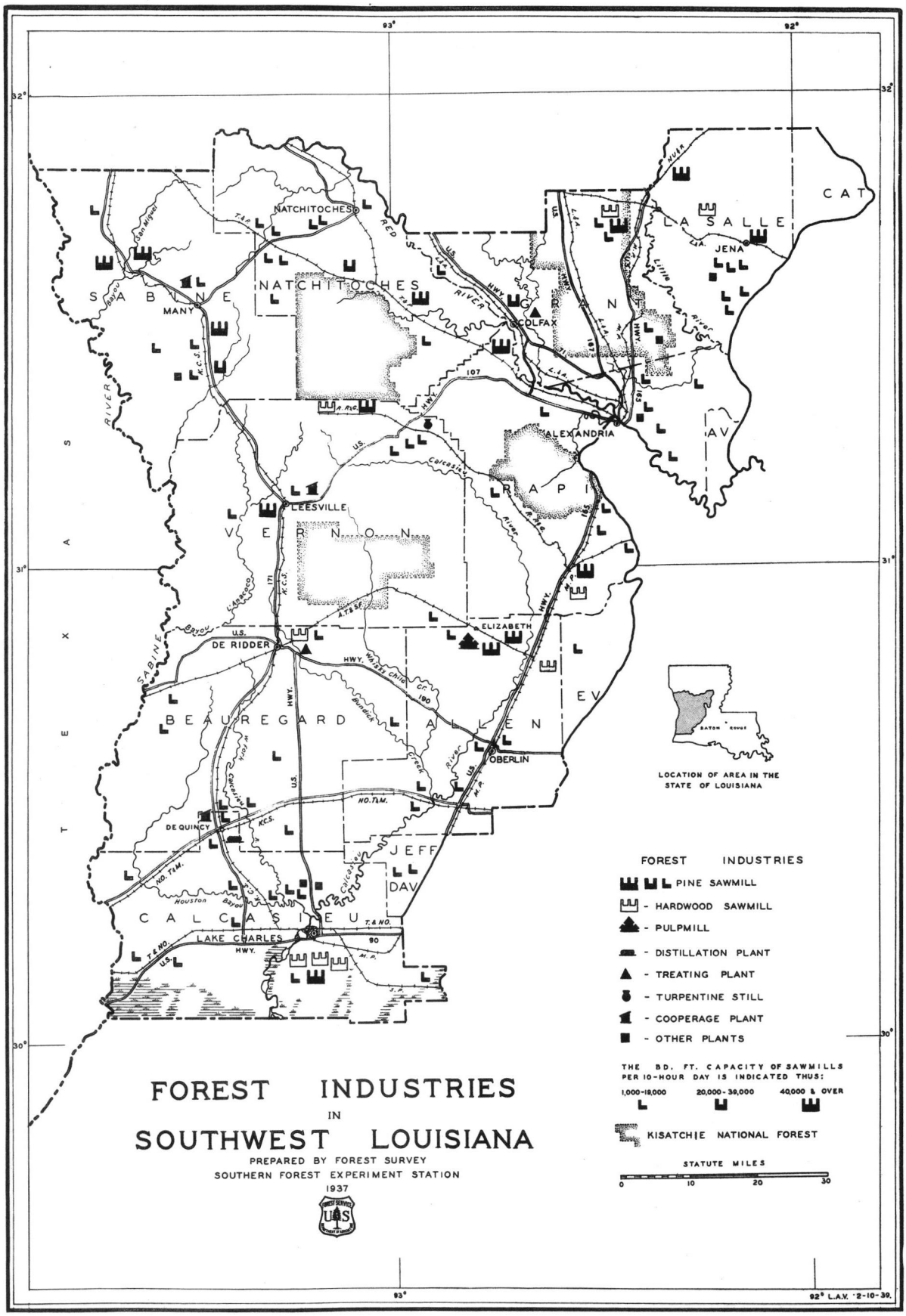


FIGURE II - FOREST INDUSTRIES MAP.

Contributions to the wood requirements of plants both inside and outside the unit and the local production of poles, piles, cross ties, fuel wood, and fence posts form an important part of the forest-utilization activity. In 1937, nearly 2 million board feet of veneer blocks were shipped to Texas and north Louisiana, while 2-1/3 million board feet of cooperage stock went to plants in Louisiana outside the unit. Pulp mills in north Louisiana obtained 8,500 cords of pulpwood from this area. Hardwood dimension stock sold to plants outside the unit amounted to 2,500 cords. In addition to this material, 229,000 poles and piles were produced, 1,019,000 hewn cross ties, 1,017,000 fence posts, and approximately 378,000 cords of fuel wood. It is estimated that the production of the above items, plus the raw material for the 14 plants in the unit, required 823,000 man-days of labor in the woods.

Summarizing the employment situation, we find that the primary forest-industrial plants (sawmills, pulp mills, distillation plants, etc.) required 1.1 million man-days for their operation in 1937. This includes labor spent in processing wood shipped into the unit from outside. Woods labor, which includes all the labor involved in cutting material to be sent out of the unit as well as that used locally, amounted to 1.3 million man-days. About 87 percent of the mill labor and 38 percent of the woods labor was in the lumber industry. It is estimated that at least 12,000 individuals were employed full or part time by the forest industries in 1937.

Commodity Drain

The amount of wood cut from the saw-timber component of the sound-tree growing stock to satisfy the needs of the various forest-industrial plants, and for use as cross ties, poles, fuel wood, fence posts, and miscellaneous items, amounted to 580 million board feet in 1937. The total drain of saw timber plus the smaller sizes was 112 million cubic feet of wood without bark, or 1.5 million cords of wood with bark. Table 13, which shows these volumes distributed according to use, substantiates the fact that 80 percent of the saw-timber drain was caused by the lumber industry. It is estimated that about 94 percent of the total drain from the saw-timber material in merchantable trees was utilized; the remainder was wasted because of incomplete utilization of the felled trees. The drain on the saw-timber portion of the trees, including both the utilized and wasted portions, is expressed in board feet, while the volumes given in cubic feet and cords include drain on saw-timber material, upper stems of sawlog-size pines, and small trees ranging from 5.0 inches d.b.h. to sawlog size.

Table 13. - Commodity drain from sound trees, 1937

Commodity	Saw-timber material			All material			
				With bark		Without bark	
	Pine	Hardwood	Total	Pine	Hardwood	Pine	Hardwood
	- Thousand board feet - (lumber tally)			Thousand cords		Thousand cubic feet	
Lumber	327,400	133,900	461,300	769.3	251.6	58,870	19,370
Cross ties	37,800	8,300	46,100	96.4	19.5	7,370	1,490
Poles and piles	15,800	1,200	17,000	43.1	2.7	3,300	210
Veneer	600	1,400	2,000	1.4	2.7	110	210
Cooperage	100	3,200	3,300	.6	6.9	50	530
Pulpwood	8,600	-	8,600	35.0	.1	2,650	10
Misc. manufactures	negl.	2,100	2,100	negl.	5.2	negl.	380
Fuel wood	27,700	6,900	34,600	179.3	38.5	12,580	2,570
Fence posts	800	100	900	8.4	.4	630	20
Misc. farm use and land clearing	2,600	1,200	3,800	15.4	11.6	1,090	770
Total	421,400	158,300	579,700	1,148.9	339.2	86,650	25,560

Comparison of Increment and Drain

It has not been possible to keep the inventory figures of 1935 up-to-date by forest conditions, but by computing growth and mortality and determining commodity drain each year, the total volume of growing stock on Jan. 1 of each succeeding year has been determined. Tables 14 and 15, which are for 1937, exemplify the method used for 1935 and 1936 and lead to an estimate of the volume of growing stock as of Jan. 1, 1938.

Table 14 shows that the volume of saw-timber material, when expressed as a total, decreased by 80 million board feet during the year. The longleaf pine growing stock was reduced about 9 percent in this year, but such heavy cutting is in some respects justified, as 69 percent of the longleaf volume in 1935 was in old-growth stands that were losing more volume through mortality than they were gaining by increment. The cut of shortleaf and loblolly was greater than that of longleaf, but the volume in these species is largely in fast-growing young timber where growth greatly exceeds mortality, so that the resulting increment in these species was more than ample to meet cutting needs. In the old-growth hardwoods, mortality is less than the growth, but the increment does not equal the drain. The 12 million board feet of surplus increment shown in table 14 is due to the abundance of increment in the younger hardwood stands. In both the pines and hardwoods, the cut is concentrated in the larger sound trees and, in the hardwoods particularly, in the more valuable species. The result is to reduce gradually the average size of the saw-timber trees and to increase the proportion of cull trees and inferior species.

Table 14. - Balance between increment and drain of saw-timber material, 1937

Item	Longleaf	Shortleaf and loblolly	Hardwood	Total
	- - - Thousand board feet (lumber tally) - - -			
Growing stock, Jan. 1, 1937	1,455,600	3,599,300	4,431,100	9,486,000
Growth	57,200	315,600	205,500	578,300
Mortality	20,200	23,600	35,200	79,000
Net increment	37,000	292,000	170,300	499,300
Commodity drain	165,500	255,900	158,300	579,700
Net change in growing stock	-128,500	36,100	12,000	-80,400
Growing stock, Jan. 1, 1938	1,327,100	3,635,400	4,443,100	9,405,600

In addition to the drain upon saw timber there is a considerable drain upon smaller material, such as pulpwood, fuel wood, fence posts, and small poles, that is expressed most conveniently in cubic feet. Table 15 summarizes the effect of increment and drain upon saw timber plus this supplemental material, expressed in cubic feet inside bark. It is noteworthy that the inclusion of the younger, smaller, and fast-growing timber influences the increment so favorably that the stand as a whole increased 14 million cubic feet during the year.

Table 15. - Balance between increment and drain of saw-timber and cordwood material, 1937

Item	Longleaf	Shortleaf and loblolly	Hardwood	Total
	- - - Thousand cubic feet (inside bark) - - -			
Growing stock, Jan. 1, 1937	300,290	1,021,130	1,319,920	2,641,340
Growth	13,170	76,230	60,880	150,280
Mortality	3,650	7,750	12,640	24,040
Net increment	9,520	68,480	48,240	126,240
Commodity drain	29,300	57,350	25,560	112,210
Net change in growing stock	-19,780	11,130	22,680	14,030
Growing stock, Jan. 1, 1938	280,510	1,032,260	1,342,600	2,655,370

A comparison between increment and drain of sawlog-size pines and hardwoods is presented in figure 12 for 1935, 1936, and 1937. The figure shows that the cut of pine saw timber has gradually increased each year and in each of these years has exceeded the increment by at least 40 million board feet. Oddly enough, however, the increment of pine saw timber has likewise increased each succeeding year. This is because a large part of the saw-timber cut is taken from the old-growth stands that have little net increment, thus leaving the second-growth stands with an excess of increment over drain. These second-growth stands, therefore, gradually increase in volume, and as growth is rapid and young trees are constantly attaining sawlog size, the resulting increment is progressively greater. In the hardwoods, the relation of increment to drain in the various forest conditions is similar to that in the pine species, but the overcut of 1935 was so heavy that it is reflected in a reduced increment in both 1936 and 1937, even though drain in these 2 years had also decreased.

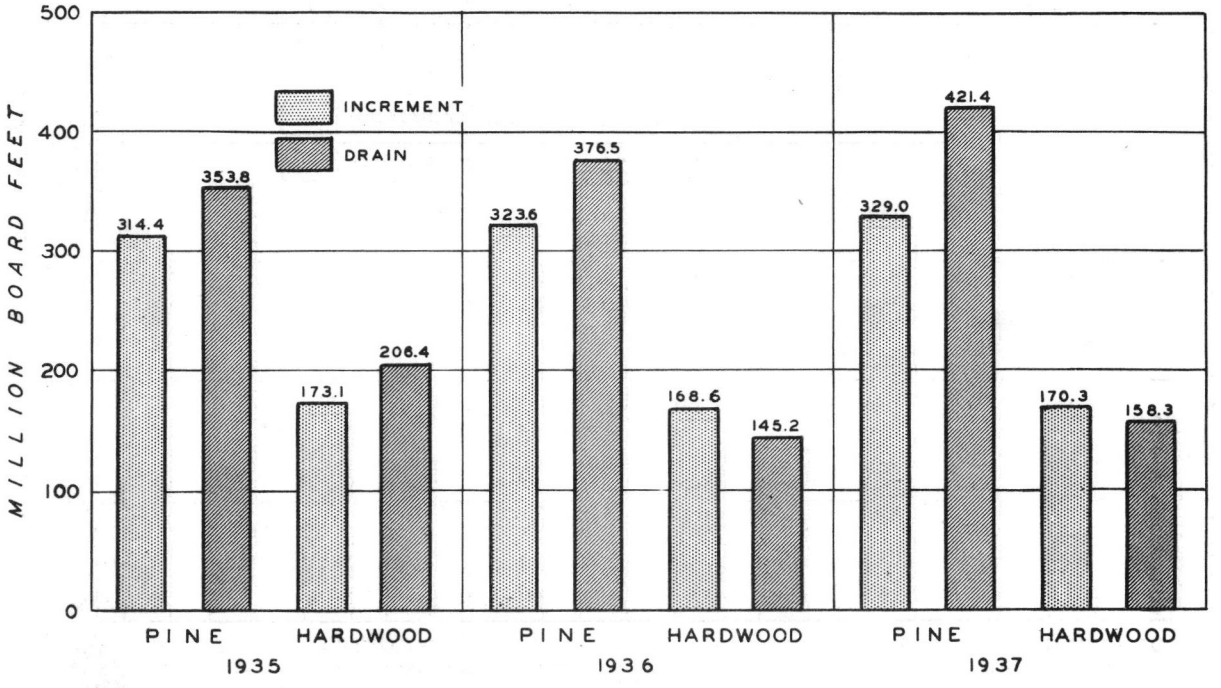


FIGURE 12 - COMPARISON OF NET INCREMENT OF SAWLOG-SIZE MATERIAL WITH SAW-TIMBER DRAIN IN 1935, 1936, 1937.

The change that occurred in the old-growth and second-growth growing stock over a 3-year period is shown by species-groups in figure 13, which bears out the assertion that the old-growth stands of both pine and hardwood are being reduced in volume, gradually but constantly, while the second-growth stands are increasing steadily. It is highly desirable that this trend in second growth be continued and accelerated in order that the growing stock of second-growth timber may satisfy, as completely as possible, the demand for saw-timber material that will continue after the exhaustion of the virgin stands. Inasmuch as the main body of old-growth pine will be cut-out in a few years, at the prevailing rate of use, no time should be wasted before taking steps to increase the productivity of the second-growth stands through increased fire protection, thinnings, improvement cuttings, and building up the growing stock by restricting the cut to less than the annual growth.

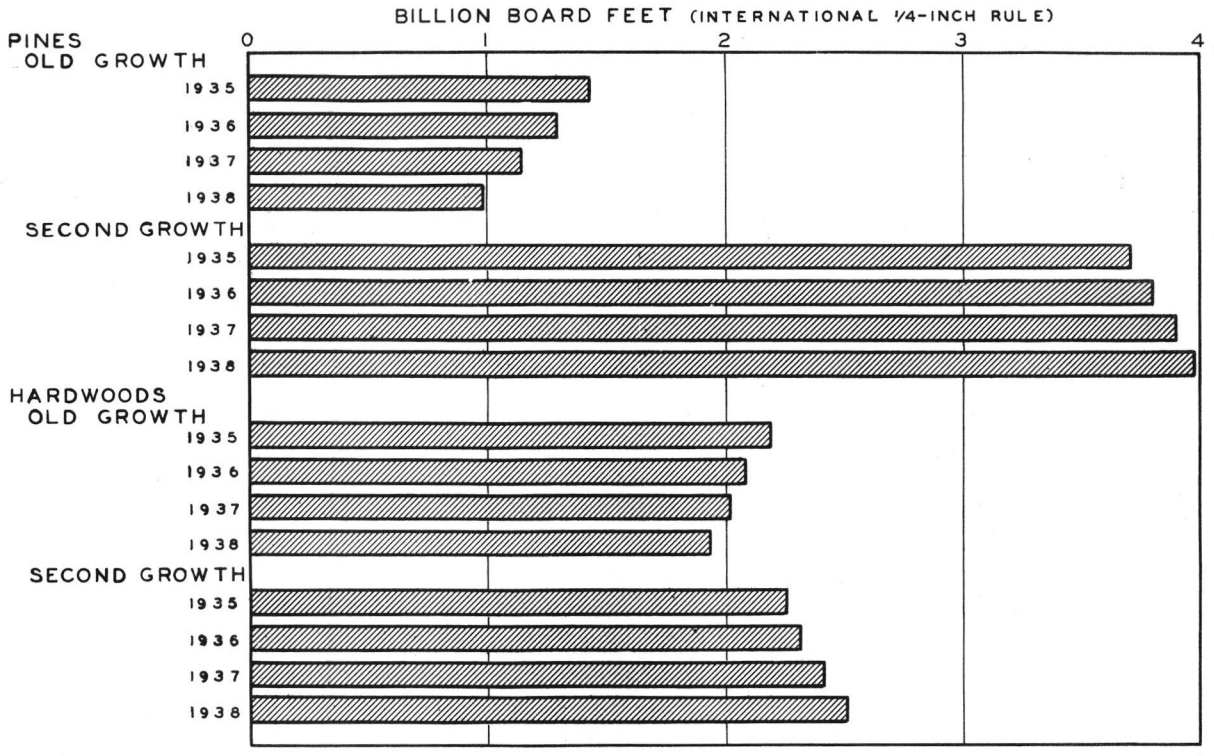


FIGURE 13 - GROWING STOCK BY SPECIES-GROUPS AND FOREST CONDITIONS ON JAN. 1 OF 1935, 1936, 1937, AND 1938.

Summary of the Present Situation

The forest in the economic picture

The exploitation of the formerly vast timber resource was the leading factor in the original development of the towns, railroads, and economic structure of this area. Most of the old-growth longleaf pine, upon which the lumber industry was based, has been removed; and many of the sawmill communities such as Pickering, Neame, and Cravens have disappeared, leaving the forest industries diminished in importance but still highly essential to the region. Forest land occupies 79 percent of the area, but over wide areas it is nonproductive of timber for industry or local use, as about 1 million acres, or 24 percent of the forest area, have been practically denuded of trees. The timbered portion contains a growing stock of 5 billion board feet of pine and $4\frac{1}{2}$ billion feet of hardwood, which together produced half a billion board feet of increment in 1937. Ninety-five sawmills and 14 other wood-using plants distributed at least 4 million dollars in wages to 12,000 or more woods and mill workers in 1937. The value of lumber produced at the sawmills in 1935 was approximately 40 percent of the value of all products manufactured in the unit that year. Since forest lands, along with their timber, bear about one-fifth of the total assessed tax valuation of the unit, as allocated by the Louisiana Tax Commission in 1937, they contribute a large part of the State and parish taxes. Forest products make up an important part of the railroad tonnage in the area and also contribute appreciably to the export trade of Lake Charles, the only seaport, about 20 percent of whose exports in 1936, both in tons and in dollar value, were forest products, mostly lumber.

Deficiencies in the present forest

1. The most striking and serious defect in the forests of southwest Louisiana is the appalling acreage of denuded land. Over 1 million acres are so denuded of trees that natural restocking to desirable species, within a reasonable time, is impossible. Reference to figure 6A shows that 54 percent of the longleaf land is in this unproductive condition.

2. Another major shortcoming is that the present average forest yield is far below the optimum offered by the soil, climate, and species. There are two important contributing factors: First, the large area of clear-cut land produces almost no annual increment; secondly, the stands in the timbered areas are too sparsely stocked. Frequent fires have prevented the survival of young seedlings, killed small trees, and seriously damaged many of the larger trees, so that the stands, on the average, contain far below the number of stems and usable volume the site will sustain. This understocked condition is further aggravated by present over-cutting on much of the forest area.

3. The small proportion of larger trees is unfavorable for the continued production of the better grades of saw timber. Most of the timber is second growth, and the decline in the supply of old-growth timber has resulted in the practice of "high-grading" the young stands, leaving stands made up predominantly of the smaller trees. More than 97 percent of the trees, both pines and hardwoods, are under 15 inches d.b.h.

4. In the hardwoods there is a growing scarcity of the more valuable species, such as forked-leaf white oak, ash, and the better species of red oak, owing to the common practice of concentrating the cut in the species that provide the most opportunity for profit. Immediate economic conditions usually dictate the cutting practices followed, but for continued long-time production it is poor silviculture to leave only the inferior species, as they occupy the growing space that could be used more profitably by better ones and foster the retrogression of the forest by reseeding the ground to the less desirable species.

Measures for improving the forest

Any plan that attempts to set up ways and means of improving the forest in this unit must recognize that about three-fourths of the forest land is largely under-stocked with timber, while one-fourth is clear-cut. For each of these situations the first step toward improvement is intensification of the present system of fire control throughout the several million acres of privately-owned forest land. Prevention of fire is essential for the survival of planted tree seedlings. Its elimination in the partly stocked forest will allow many more young trees to mature and augment the volume of growing stock, and at the same time will reduce the volume lost through decay and death of the older trees.

The clear-cut forest land best suited for continued timber production should be restored to productivity as rapidly as protection from fire can be assured. This can be accomplished within a reasonable length of time only through a planting program participated in by both public agencies and private owners. The amount of clear-cut land that should be planted is problematical, but the need for timber in the area, the proven suitability of the soil and climate, and the opportunity for profit in timber growing, lend weight to the claim that a large part of the million acres of denuded land has its highest use in timber production.

A million acres of denuded land presents a grave problem, it is true, but its seriousness must not hide the fact that there are also $3\frac{1}{2}$ million acres of forest land in the unit insufficiently stocked with timber. The whole burden of providing timber for the present and future wood-using industries must fall upon these partly stocked stands until the denuded land is again productive, and even then they should contribute their share. At present the net annual growth of these stands does not equal the volume of wood removed for industrial and domestic use. Fortunately, however, there is opportunity to increase both the quantity and quality of the yield from the forest growing stock through application of tested forest-management practices. In addition to intensive fire protection, these call for improvement cuttings to remove trees that are defective and of poor form, thinnings in young growth, planting in areas that will not restock naturally to the proper density, spreading the cut to include inferior species, and conservative cutting to leave a volume equivalent to part of the annual increment in the stand until the growing stock is built up to its optimum volume per acre. The responsibility for initiating these forestry practices rests with the private owner, but public agencies should cooperate fully, as the benefits of a stabilized industry, based upon a permanent and ample resource, extend not only to southwest Louisiana but also to the State and the Nation.

Forest Type-Groups

Longleaf pine. - Includes the following forest types: longleaf pine, longleaf and loblolly pine, longleaf and shortleaf pine, longleaf pine and mixed hardwoods. Almost 85 percent of the net cubic volume is longleaf pine.

Shortleaf-loblolly pine. - Includes the following forest types: shortleaf pine, loblolly pine, shortleaf and loblolly pine. About 85 percent of the net cubic volume is shortleaf and loblolly pine.

Shortleaf-loblolly-hardwood. - Includes the following forest types: shortleaf pine and mixed hardwoods, loblolly pine and mixed hardwoods. About 45 percent of the net cubic volume is pine; the remainder is mixed hardwoods.

Upland hardwood. - Includes the following forest types: upland hardwoods, scrub hardwoods. About 90 percent of the net cubic volume is mixed hardwoods; scattered pines account for the remainder.

Bottom-land hardwood. - Includes the following forest types: cypress-tupelo, bottom-land hardwoods. About 50 percent of the net cubic volume is red, black, and tupelo gums, bay, cypress, red maple, and other pulping hardwoods; the remainder is in species such as oaks, hickories, ash, beech, elm, and hackberry, with a small amount of loblolly pine.

Forest Conditions

Old-growth uncut. - Old-growth stands from which less than 10 percent of the volume has been cut.

Old-growth partly cut. - Old-growth stands from which 10 percent or more of the volume has been cut, but in which the remaining old-growth saw timber contains at least 1,000 board feet per acre of hardwood, or 600 board feet of pine or pine and hardwood mixed.

Second-growth sawlog-size uncut. - Second-growth stands from which less than 10 percent of the sawlog-size trees have been cut and in which the remaining saw timber contains at least 600 board feet per acre.

Second-growth sawlog-size partly cut. - Second-growth stands from which 10 percent or more of the sawlog-size trees have been cut, and in which the remaining saw timber contains at least 400 board feet per acre.

Second-growth under sawlog size. - Second-growth stands composed largely of under-sawlog-size trees, and containing less than 600 board feet per acre.

Reproduction. - Areas insufficiently stocked to classify as second growth, but bearing per acre more than 80 seedlings less than 1 inch d.b.h.

Clear-cut. - Cut-over areas in which an insufficient quantity of young growth has come in to classify them either as second growth or as reproduction.

Diameters

D.B.H. (diameter breast height). - Diameter, outside of bark, $4\frac{1}{2}$ feet above the ground.

A 2-inch diameter-class includes diameters 1 inch below and 0.9 inch above the stated midpoint, e.g., the 6-inch class includes trees 5.0 to 6.9 inches d.b.h. Corresponding limits apply to the other diameter-classes.

Tree Classification

Sawlog-size tree. - A pine or cypress tree at least 9.0 inches d.b.h., or a hardwood tree at least 13.0 inches d.b.h., which will produce 1 sound butt log at least 12 feet long, or which contains at least 50 percent of its gross saw-timber volume in sound material in case the butt log is a cull.

Under-sawlog-size tree. - Any tree between 1.0 inch and the minimum merchantable diameter at breast height, at least 75 percent sound and with a reasonably straight stem.

Cull tree. - A sound tree which, because of form, crook, extreme limbiness, or other sound defect, is not, and never will become, suitable for saw timber. Also a sawlog-size tree that is more than 50 percent defective, or an under-sawlog-size tree that is more than 25 percent defective.

Volume Estimates

Board-foot volume. - Only sawlog-size trees are included in this estimate. Top diameters vary with the limits of usable material, but no hardwood logs less than 8.5 inches in diameter at the small end, nor any pine logs less than 5.5 inches, are included. Deductions are made for woods cull, such as rot, fire scar, crook, limbiness, and similar defects, as well as for loss in sawing at the mill due to sweep and hidden defects.

Cordwood volume. - This includes the entire stand of sound trees at least 5.0 inches d.b.h., outside bark, and contains material from:

1. Sound trees sawlog size—the merchantable sawlog portion of saw-timber trees.

2. Upper stems of sawlog-size pine trees—the portion of saw-timber trees not used as sawlogs but usable as cordwood. This includes only the upper stems to a variable top-diameter limit (but not less than 4 inches).

3. Sound trees under sawlog size—the full stems of both pines and hardwoods at least 5.0 inches d.b.h. to a variable usable top-diameter (but not less than 4 inches).

Deduction is made for woods cull, such as rot, fire scar, excessive crook, bad knots, or other defects.

Additional material included in table 5 is the estimated sound usable portion of cull trees at least 5 inches d.b.h. and the upper stems and limbs of sawlog-size hardwoods and cypress.

Cubic-foot volume contains the material described under "Cordwood volume." It includes no bark except in figure 3.

Pine Tree Grades

Smooth tree. - A tree with at least 20 feet of clear length and at least 50 percent of the total usable length practically free of limbs and knots.

Limby tree. - A tree with at least 12 feet of clear length and with 30 to 49 percent of the total usable length practically free of limbs and knots.

Rough tree. - A merchantable tree not clear enough to be put in either of the previous classes.

Hardwood Log Grades

Grade 1. - Logs suitable for industrial lumber. They must be at least 12 feet long and 14 inches (ash, 12 inches) in top diameter, with at least 50 percent sound volume. Defects must leave 60 percent of the surface clear, and the log should produce at least 30 percent No. 1 common lumber.

Grade 2. - Logs suitable for cooperage and small dimension use. They must be at least 10 feet long and 10 inches (ash, 9 inches) in top diameter, with at least 50 percent sound volume. Defects must leave 60 percent of the surface clear, and the logs should produce at least 30 percent of No. 1 common lumber, but they may have sweep that would disqualify them for Grade 1 logs.

Grade 3. - Logs suitable only for ties, headings, crates, boxes, and rough structural material. They must be at least 8 feet long and 10 inches in top diameter, with at least 50 percent sound volume.